FACULTY OF ENGINEERING

DEGREE OF BACHELOR OF TECHNOLOGY IN BIOTECHNOLOGY

DEPARTMENT OF BIOTECHNOLOGY

CURRICULUM

(2023 - 2024)



KARPAGAM ACADEMY OF HIGHER EDUCATION

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



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FACULTY OF ENGINEERING

DEGREE OF BACHELOR OF ENGINEERING / TECHNOLOGY (B. E. /B. Tech.)

REGULATIONS (2023)

CHOICE BASED CREDIT SYSTEM



KARPAGAM ACADEMY OF HIGHER EDUCATION (Deemed to be University Established under Section 3 of UGC Act 1956) Eachanari, Coimbatore-641 021. INDIA

FACULTY OF ENGINEERING DEGREE OF BACHELOR OF ENGINEERING / TECHNOLOGY

REGULAR PROGRAMME

REGULATIONS 2023

CHOICE BASED CREDIT SYSTEM

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

1. ADMISSION

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

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

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

(OR)

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

1.2 Lateral Entry Admission

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

OR

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

OR

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

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

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

1.3 Migration from other University

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

2. PROGRAMMES OFFERED

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

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

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

3. MODE OF STUDY

3.1 Full-Time:

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

3.2 Conversion from full time mode of study to part time is not permitted.

3.3 Change from one programme to another is not permitted.

4. STRUCTURE OF PROGRAMMES

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

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

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

(V) Choice Based Credit System

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

4.2 Each course is normally assigned certain number of credits.

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

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

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

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

4.5 The medium of instruction for all Courses, Examinations, Seminar presentations and

Project/Thesis reports is English.

4.6 Value Added Course

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

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

5. DURATION OF THE PROGRAMME

5.1The prescribed duration of the programme shall be

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

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

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

6. REQUIREMENTS FOR COMPLETION OF THE SEMESTER

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

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

6.3 Candidates who are not recommended for condonation and those who have less than 65%

attendance will not be permitted to proceed to the next semester and have to redo the course. However, they are permitted to write the arrear Examinations, if any.

7. CLASS ADVISOR

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

8. CLASS COMMITTEE

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

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

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

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

8.4 The Chairperson of the Class Committee may convene the meeting of the class committee.8.5 The Dean may participate in any Class Committee of the Faculty.

- **8.6** The Chairperson is required to prepare the minutes of every meeting, submit the same to Dean through the HOD within two days of the meeting and arrange to circulate it among the students and teachers concerned. If there are some points in the minutes requiring action by the Management, the same shall be brought to the notice of the Registrar by the HOD throughDean.
- **8.7** The first meeting of the Class Committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the regulations. Two subsequent meetings may be held in a semester at suitable intervals. During these meetings the student members representing the entire class, shall meaningfully interact and express their opinions and suggestions of the other students of the class in order to improve the effectiveness of the teaching-learning process.

9. COURSE COMMITTEE FOR COMMON COURSES

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

10. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

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

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

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

THEORY COURSES:

*Evaluation shall be made by a committee.

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

PATTERN OF TEST QUESTION PAPER (Test I & II)

PATTERN OF TEST QUESTION PAPER (Test III)

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

PRACTICAL COURSES:

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

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

INTEGRATED THEORY AND PRACTICAL COURSES:

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

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

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

10.3 ATTENDANCE

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

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

10.4 PROJECT WORK/ INTERNSHIPS:

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

10.5 CERTIFICATION COURSES:

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

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

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

12. END SEMESTER EXAMINATION

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

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

PATTERN OF ESE QUESTION PAPER:

13. PASSING REQUIREMENTS

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

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

13.2 If the candidate fails to secure a pass in a particular course ESE, it is mandatory that candidate shall register and reappear for the Examination in that course during the subsequent semester when

Examination is conducted in that course. Further the candidate should continue to register and reappear for the Examination till a pass is secured in such supplementary Examination within the stipulated maximum duration of the programme (Clause 5.1).

The CIA marks obtained by the candidate in his/her first or subsequent appearance where he/she secures a pass shall be retained by the office of the Controller of Examinations and considered valid for all remaining attempts till the candidate secures a pass in his/her ESE.

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

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

13.4 ONLINE COURSE(MOOC) COORDINATOR

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

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

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

14. AWARD OF LETTER GRADES

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

Letter grade	Marks Range	Grade Point	Description
0	91 - 100	10	OUTSTANDING
A+	81-90	9	EXCELLENT
Α	71-80	8	VERY GOOD

B+	66- 70	7	GOOD
В	61 - 65	6	ABOVE AVERAGE
С	55 - 60	5	AVERAGE
D	50 - 54	4	PASS
RA	<50	-	REAPPEARANCE
AB		0	ABSENT

14.2 GRADE SHEET

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

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

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

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

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

14.3 REVALUATION

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

14.4 TRANSPARENCY AND GRIEVANCE COMMITTEE

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

15. ELIGIBILITY FOR AWARD OF DEGREE

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

- Successfully gained the required number of total credits as specified in the curriculum corresponding to his/her programme within the stipulated time.
- No disciplinary action is pending against him/her.

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

Academy of Higher Education.

16. CLASSIFICATION OF THE DEGREE AWARDED

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

17. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

17.1 A candidate may for valid reasons and on prior application, be granted permission to Withdraw

from appearing for the examination of any one course or consecutive examinations of more than one course in a semester examination.

- **17.2** Such withdrawal shall be permitted only once during the entire duration of the degree programme. Withdrawal application shall be valid only if the candidate is otherwise eligible to write the Examination
- .17.3 Withdrawal application is valid only if it is made within 10 days prior to the commencement of the Examination in that course or courses and recommended by the Head of the Department, Dean and approved by the Registrar.
- **17.3.1** Notwithstanding the requirement of mandatory TEN days notice, applications for withdrawal for special cases under extraordinary conditions may be considered on the merit of the case.
- **17.4**Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction. This provision is not applicable to those who seek withdrawal during III semester.
- **17.5** Withdrawal from the ESE is NOT applicable to arrear Examinations.
- **17.6** The candidate shall reappear for the withdrawn courses during the Examination conducted in the subsequent semester.

18. PROVISION FOR AUTHORISED BREAK OF STUDY

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

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

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

18.4 The total period for completion of the programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specifiedin

Clause 5.1 irrespective of the period of break of study (vide Clause 18.3) in order that he/she maybe eligible for the award of the degree.

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

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

20. INDUSTRIAL VISIT

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

21. DISCIPLINE

Every student is required to observe discipline and decorous behavior both inside and outside the University and not to indulge in any activity which will tend to bring down the prestige of the University. The erring student will be referred to the Disciplinary Committee constituted by

the University, to enquire into acts of indiscipline and recommend to the University about the disciplinary action to be taken.

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

22. REVISION OF REGULATION AND CURRICULUM

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

23.KARPAGAM INNOVATION AND INCUBATION COUNCIL (KIIC)

(A Section 8 Company)

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

23.1 Norms to Student Start-Ups

- a) Any (UG/PG /(Ph.D.) Research scholars, student, right from the first year of their programme is allowed to set a startup (or) work part time/ full time in a startup or work as intern in a startup
- b) Any (UG/PG / (Ph.D.) Research scholars) student right from the first year of their programme is allowed to earn credit for working on Innovative prototypes/business Models/ Pre incubation(case to case basis). Start Up activities will be evaluated based on the guidelines being given by the expert committee of the KIIC

- c) Student Entrepreneurs may use the address of incubation center (KIIC) to register their venture while studying in KAHE.
- d) Students engaged in startups affiliated with the KIIC or those who work for them may be exempted from KAHE's attendance requirements for academic courses under current regulations, up to a maximum of 30% attendance per semester, including claims for ODs and medical emergencies Potential Students who have been incubated at KIIC may be permitted to take their University semester exams even if their attendance is below the minimum acceptable percentage, with the proper authorization from the head of the institution.

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

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

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

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

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

Department of Biotechnology (B.Tech)

B.TECH BIOTECHNOLOGY

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

- 1. To prepare the graduates with strong knowledge and practical skills in their professional career.
- 2. To prepare the graduates to function effectively in teams by upholding their code of bioethical principles.
- 3. To prepare the graduates to pursue lifelong learning to address the societal issues for progressive development.

PROGRAM OUTCOME (PO)

The graduates of Biotechnology (B.Tech.) will be able to

- **a. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
- **b. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **c. Design/development of solutions:** Design solutions for complex 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
- **d.** Conduct investigations of complex problems: 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
- e. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **f.** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
- **g.** Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
- h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore - 641 021

norms of the engineering practice.

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

PROGRAMME SPECIFIC OUTCOMES (PSO)

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

- 1. Apply the knowledge in fundamental sciences and engineering that are essential to understand the complex biological system
- 2. Apply the working knowledge to apply for advanced biological sciences and technologies.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	\checkmark											
PEO2							\checkmark	\checkmark	~	\checkmark	\checkmark	
PEO3		✓	\checkmark			✓	✓					✓

PEO – PO Mapping

PEO-PSO Mapping

	PSO 1	PSO 2
PEO1	\checkmark	\checkmark
PEO2		\checkmark
PEO3	\checkmark	\checkmark



KARPAGAM ACADEMY OF HIGHER EDUCATION

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

FACULTY OF ENGINEERING B.Tech. -BIOTECHNOLOGY COURSE OF STUDY AND SCHEME OF EXAMINATION

2023 BATCH ONWARDS

23	DAI	СП	UN	V V 2	AND	'
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CourseCode		Objectives & 0 0 0 0			Instruction hours/week			s	Maximum Marks			Page No.
	Course Title	Categ	DO	BEO		т	D	redit	CIA	ESE	Total	
			PO	P80	L	1	r	C	40	60	100	
23BTCC101	Professional Communicative English	HS	8,9,10,12	-	3	0	0	3	40	60	100	1
23BTCC102	Matrices and Calculus	BS	1,2,3,12	-	3	1	0	4	40	60	100	3
23BTCC103	Environmental Studies	BS	1,2,6,7,8,10,12	1	3	0	0	3	40	60	100	6
23BTBT141	Engineering Physics	BS	1,2,3,6,9,10, 12	-	4	0	2	5	40	60	100	9
23BTCC142	Programming in C	ES	1,2,3,4,9,10,12	1	4	0	2	5	40	60	100	12
23BTCC111	Engineering Graphics	ES	1,2,3,4,8,10,12	1	2	0	2	3	40	60	100	16
23BTMC151	Design Thinking	MC	3,4,7,8,9,10,12	-	1	0	2	2	100	-	100	19
23BTMC152	Sports and Yoga	MC	-	-	1	0	0	0	100	-	100	21
23BTMC153	தமிழர் மரபும் பண்பாடும்	MC	-	-	1	0	0	0	100	-	100	23
	TOTAL				22	1	8	25	540	360	900	
			SEMESTE	R II								
Cours		gory	Control Contro			Instruction hours/week			Maximum M		arks	
eCode	Course Title	Cate	РО	PSO	L	т	Р	Cred	CIA	ESE	Total	
							_		40	60	100	
23BTCC201C	Transforms & its applications	HS	1,2,3,12	-	3	1	0	4	40	60	100	26
23BTBT202	Bio Physics	BS	1,2,3,6,8,10,12	-	3	0	0	3	40	60	100	29
23BTCC241	Engineering Chemistry	BS	1,2,3,4,6,7,8,9, 10,12	-	3	0	4	5	40	60	100	32
23BTCC242	Basic Electrical and Electronics Engineering	ES	1, 2, 3, 4, 9, 10, 12	1	3	1	2	5	40	60	100	35
23BTCC243	Object Oriented Programming with Python	ES	1,2,3,4,9,10,12		3	0	2	5	40	60	100	38
23BTMC251	Soft Skills	MC	-	-	1	0	0	0	100	-	100	41
23BTMC252	Women Safety and Security	МС			0	0	1	0	100	0	100	42
	TOTAL				16	2	9	22	400	300	700	

			SEMI	ESTER III									
Course		ry	Obje Ou	ctives & tcomes		Inst hou	tructions/we	on ek	ts	Max	imum M	arks	Page
Code	Course Title	atego	PO	PSO		T	т	р	redit	CIA	ESE	Total	-INO.
		Ü	10	150	•	Ľ	1	1	0	40	60	100	
23BTBT301	Principles of Chemical Engineering	ES	1, 2, 6	1,	2	3	1	0	4	40	60	100	43
23BTBT302	Molecular Biology and Genetics	PC	1, 2, 3, 12	1,	, 2	3	0	0	3	40	60	100	46
23BTBT341	Biochemistry	PC	1, 2,3, 9, 1 12	0,	1	3	0	2	4	40	60	100	48
23BTBT342	Microbiology	PC	1, 2, 3, 7, 9 10, 12),	1	3	0	2	4	40	60	100	51
23BTBT343	Cell Biology	PC	1, 2, 3, 9, 1 12	.0, 1		3	0	2	4	40	60	100	54
23BTMC351	Aptitude and reasoning	MC	1,2,3,12		-	1	0	0	0	100	0	100	57
23BTMC352	Foreign Language (French/ Germen)	MC	-		-	1	0	0	0	100	0	100	59
23BTBT391	Internship/Field Project	PW	-		-	0	0	2	1	100	0	100	62
	TOTAL					17	1	8	20	500	300	800	
			SEMESTE	ER IV		1	1	I		1			-
			Obie	ctives &		Inst	tructi	on					-
Course	Course Title	ry	Ou	tcomes		hours/wee		s/week		Max	imum M	arks	_
Code	Course Thie	atego	РО	PSO		L	Т	Р	Credit	CIA	ESE	Total	
		C							•	40	60	100]
23BTBT401	Biostatistics	BS	1, 2, 3, 12	-		3	1	0	4	40	60	100	63
23BTBT402	Chemical Thermodynamics	ES	1, 2	1		3	1	0	4	40	60	100	66
23BTBT403	Basics of Industrial Biotechnology	PC	1, 2, 3, 5, 12	2		3	0	0	3	40	60	100	68
23BTBT441	Analytical Techniques	PC	1, 2, 3, 9, 10, 12	2		3	0	2	4	40	60	100	71
23BTBT442	Genetic Engineering	PC	1, 2, 3, 9, 10, 12	1, 2		3	0	2	4	40	60	100	74
23BTBT4E	Professional Elective -I	PE				3	0	0	3	40	60	100	
23BTMC451	Foundation of Entrepreneurship	MC	-	-		2	0	0	0	100	0	100	77
23BTMC452	Essence of Traditional Indian Knowledge&Heritage	MC	-	-		2	0	0	0	100	0	100	78
	тс	TAL				22	2	4	22	440	360	800	
	1					I		I					

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore – 641 021

SEMESTER V												
Course	Course Title		Objectives & Outcomes		Instr hour	uctio s/wee	n k		Maxi	Page No.		
Code	course mite	<u>Y</u>	D O	DGO	т	т	р	ts	CIA	ESE	Total	
		Catego	PO	P\$0	L	1	P	Credi	40	60	100	
23BTBT541	Bioprocess Engineering	PC	1, 2, 3, 9, 10	2	3	1	2	5	40	60	100	79
23BTBT542	Immunology and Immunotechnoloy	PC	1, 2, 3, 9, 10, 12	2	3	0	2	4	40	60	100	82
23BTBT543	Bioinformatics	PC	1, 2, 3, 5, 9, 10, 12	1, 2	3	0	2	4	40	60	100	85
23BTBT5E_	Professional Elective II	PE	-	-	3	0	0	3	40	60	100	
23BTBT5E_	Professional Elective III	PE	-	-	3	0	0	3	40	60	100	
23BTBT551	Cybersecurity	MC	1,2,3,6	-	2	0	0	0	100	0	100	111
23BTBT591	Internship/Field Project	PW			0	0	2	1	100	0	100	113
	TOTAL				17	1	8	20	400	300	700	
			SEMES	FER VI								
Course		y	O	ojectives & Dutcomes	Ins hou	Instruction hours/week			Maxii	mum Ma	arks	
Code	Course Title	Categor	РО	PSO	L	Т	Р	Credits	CI A	ESE	Total	
		-							40	60	100	
23BTBT601	Heat and Mass Transfer	PC	1, 2, 3	1	3	1	0	4	40	60	100	114
23BTBT602	Biopharmaceutical Technology	PC	1, 2	1	3	0	0	3	40	60	100	117
23BTBT641	Animal & Plant Biotechnology	PC	1, 2, 3, 9, 10, 12	1, 2	3	0	2	4	40	60	100	119
23BTBT642	Enzymology and Enzyme Technology	PC	1, 2, 3, 9, 10	1, 2	3	1	2	5	40	60	100	122
23BTBT6E	Professional Elective III	PE	-	-	3	0	0	3	40	60	100	
23BTBT6E_	Open Elective I	OE	-	-	3	0	0	3	40	60	100	
23BTBT651	Universional Human Values	MC	-	-	2	0	0	0	100	0	100	123
23BTBT691	Mini project	PW	11,12	-	0	0	2	1	40	60	100	125
	TOTAL				20	2	8	23	380	420	800	

B.Tech. Biotechnology

B.Tech Biotechnology

2023-2024

			SE	MESTER VII								Page No.
Course		ry	Ob	jectives & Outcomes	Ins hou	tructi rs/we	on ek	its	Maximum Marks			
Code	Course Title	atego	РО	PSO	L	Т	Р	Credi	CIA	ESE	Total]
		C					_	Ŭ	40	60	100	
23BTBT701	Genomics and Proteomics	PC	1, 2	2	3	0	0	3	40	60	100	126
23BTBT702	Biosafety, Bioethics & IPR	PC	1, 2, 8, 12	1, 2	3	0	0	3	40	60	100	128
23BTBT741	Bioseparation Engineering	PC	1, 2, 3, 5, 9, 10	2	3	0	2	4	40	60	100	131
23BTBT7E_	Professional Elective IV	PE	-	-	3	0	0	3	40	60	100	
23BTBT7E_	Professional Elective V	PE	-	-	3	0	0	3	40	60	100	
23BT_OE_	Open Elective II	OE	-	-	3	0	0	3	40	60	100	
23BTBT791	Project Work Phase - I	PW			0	0	8	4	40	60	100	132
	TOTAL	1	1		18	0	10	23	280	420	700	
			SEMEST	'ER VIII			I					
Course		k :	Ob	jectives & Outcomes	Ins hou	tructi 1rs/we	ion eek	s	Maxi	mum Ma	arks	
Code	Course Title	ategoı	РО	PSO	L	Т	Р	redit	CIA	ESE	Total	
		Ü							40	60	100	
23BTBT891	Project Work Phase - II	PW			0	0	16	8	120	180	300	133
	TOTAL	1			0	0	16	8	120	180	300	
												-
	Total					1	63					1
	Total Marks			5700							-	
				5700								

LIST OF ELECTIVES

Professional Elective - I

Coursecode	Name of the course	Objecti out c	Objectives and out comes		Instruction hours / week			Maximum Marks			Page No.
Course coue		РО	PSO	L	Т	Р	Credi	CIA	ESE	Total	
								40	60	100	
]	Professional El SEMESTI	ective - I E R – IV	1	I	1	1	1	1	1	
23BTBT4E01	Environmental Biotechnology	1, 2, 12	1, 2	3	0	0	3	40	60	100	134
23BTBT4E02	Genetics and Cytogenetics	1, 2, 3, 4, 5, 12	1, 2	3	0	0	3	40	60	100	137
23BTBT4E03	Waste Management & Upcycling	1, 2, 3, 5, 6, 7, 12	1, 2	3	0	0	3	40	60	100	139
23BTBT4E04	Food Biotechnology	1, 2	1, 2	3	0	0	3	40	60	100	141
		SEMES Professiona	TER – V l Elective – II	•	•	•					
		Objectiv	Instruction hours / week				Maximum Marks			-	
Course code	Name of the course	РО	PSO	L	Т	Р		CIA	ESE	Total	
							Credits	40	60	100	
23BTBT5E01	Good Manufacturing and Laboratory Practice	1, 2, 3, 5, 6, 12	1	3	0	0	3	40	60	100	143
23BTBT5E02	Fundamentals of Nano Biotechnology	1, 2, 3, 5, 12	1, 2	3	0	0	3	40	60	100	145
23BTBT5E03	Protein Engineering	1, 2, 3, 12	1, 2	3	0	0	3	40	60	100	147
23BTBT5E04	Bioenergy and Biofuels	1, 2, 3, 7, 12	2	3	0	0	3	40	60	100	149
		Professional	Elective – III								
23BTBT5E05	Gene Expression and Transgenics	1, 2, 3, 4, 5, 8, 12	2	3	0	0	3	40	60	100	151
23BTBT5E06	Agriculture Biotechnology	1, 2, 4, 5, 7, 12	1, 2	3	0	0	3	40	60	100	153
23BTBT5E07	Stem Cell Technology	1, 2, 5	1, 2	3	0	0	3	40	60	100	155
1				-							

	Ser	nester - VI									
Course code	Name of the course	Objective Outco	es and omes	Instruction hours / week			S	Maximum Marks			Page No.
		РО	PSO	L	Т	Р	Credit	CIA	ESE	Total	
								40	60	100	
23BTBT6E01	Structural Biology	1, 2, 5	1, 2	3	0	0	3	40	60	100	159
23BTBT6E02	Genome Editing	1, 2, 3, 5, 8	2	3	0	0	3	40	60	100	161
23BTBT6E03	Bioinputs for Agriculture	1, 2, 12	1, 2	3	0	0	3	40	60	100	163
23BTBT6E04	Fermentation Technology	1, 2, 3	1, 2	3	0	0	3	40	60	100	165
		Semeste	r - VII	г			[1
Course code	Name of the course	Objectiv out co	Objectives and out comes			ion /eek	lits	Maximum Marks			
		РО	PSO	L	Т	Р	Cree	CIA	ESE	Total	
								40	60	100	
	Р	rofessional Ele	ctive – V								
23BTBT7E01	Bioprocess Economics and Plant Design	1, 2, 3	1, 2	3	0	0	3	40	60	100	167
23BTBT7E02	Tissue Engineering	1, 2, 5, 12	1, 2	3	0	0	3	40	60	100	169
		, , - ,		5							
23BTBT7E03	Molecular Modeling and Drug Design	1, 2, 3, 5, 6	1, 2	3	0	0	3	40	60	100	171
23BTBT7E03 23BTBT7E04	Molecular Modeling and Drug Design Clinical Trial and Management	1, 2, 3, 5, 6 1, 2, 3, 8	1, 2	3	0	0	3	40	60 60	100	171
23BTBT7E03 23BTBT7E04	Molecular Modeling and Drug Design Clinical Trial and Management Pr	1, 2, 3, 5, 6 1, 2, 3, 8 ofessional Elec	1, 2 1, 2 tive – VI	3 3 3	0	0	3	40	60 60	100	171 174
23BTBT7E03 23BTBT7E04 23BTBT7E05	Molecular Modeling and Drug Design Clinical Trial and Management Pr Metabolic Engineering	1, 2, 3, 5, 6 1, 2, 3, 8 ofessional Elect	1, 2 1, 2 etive – VI 2	3 3 3	0 0 0	0 0 0 0	3 3 3	40 40 40	60 60 60	100	171 174 176
23BTBT7E03 23BTBT7E04 23BTBT7E05 23BTBT7E06	Molecular Modeling and Drug Design Clinical Trial and Management Pr Metabolic Engineering Cancer Biology	1, 2, 3, 5, 6 1, 2, 3, 8 ofessional Elect 1, 2, 5 1, 2, 12	1, 2 1, 2 tive – VI 2 1, 2	3 3 3 3 3	0 0 0 0 0	0 0 0 0 0	3 3 3 3 3	40 40 40 40 40	60 60 60 60	100 100 100 100	171 174 176 178
23BTBT7E03 23BTBT7E04 23BTBT7E05 23BTBT7E06 23BTBT7E07	Molecular Modeling and Drug Design Clinical Trial and Management Pr Metabolic Engineering Cancer Biology Data Analysis and Smulations	1, 2, 3, 5, 6 1, 2, 3, 8 ofessional Elec 1, 2, 5 1, 2, 12 1, 2, 3, 5	1, 2 1, 2 tive - VI 2 1, 2 1, 2	3 3 3 3 3 3	0 0 0 0 0 0	0 0 0 0 0 0	3 3 3 3 3 3	40 40 40 40 40 40	60 60 60 60 60	100 100 100 100 100	171 174 174 176 178 180

Open	Electives	(Offered	by	Biotechnology)
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Course code	Name of the course	Obj an co	ectives d out omes	Instruction hours / week			S	Max	Page No.		
		РО	PSO	L	Т	Р	Credit	CIA	ESE	Iarks Iarks Iarks No Image: Constraint of the second se	
								40	60	100	
Open electives											
23BTBTOE03	Basic Bioinformatics	-	-	3	0	0	3	40	60	100	184
23BTBTOE04	Fundamentals of Nanobiotechnology	-	-	3	0	0	3	40	60	100	187

LIST OF OPEN ELECTIVES (Offered by other departments)

SEMESTER VI &VII

SUB. CODE	TITLE OF THE COURSE	L	Т	Р	С	CIA	ESE	TOTAL	
	BIOMEDICAL ENGINEER	RING					•		
23BEBMEOE01	Human Anatomy and Physiology	3	0	0 0 3 40 60 100					
23BEBMEOE02	Artificial Organs and Implants	3	0	0	3	40	60	100	192
	FOOD TECHNOLOGY	7			-				
23BTFTOE01	Processing of Food Materials	3	0	0	3	40	60	100	194
23BTFTOE02	Nutrition and Dietetics	3	0	0	3	40	60	100	196
23BTFTOE03	Ready to Eat Foods	3	0	0	3	40	60	100	199
23BTFTOE04	Agricultural waste and Byproducts Utilization	3	0	0	3	40	60	100	201
23BTFTOE05	Design of Food Process Equipment	3	0	0	3	40	60	100	203
	CIVIL ENGINEERING	r J	L	•				I	
23BECEOE01	Housing Plan and Management	3	0	0	3	40	60	100	205
23BECEOE02	Building Services	3	0	0	3	40	60	100	207
23BECEOE03	Repair and Rehabilitation of Structures	3	0	0	3	40	60	100	209
23BECEOE04	Computer-Aided Civil Engineering Drawing	3	0	0	3	40	60	100	211
23BECEOE05	Contracts Management	3	0	0	3	40	60	100	213

B.Tech. Biotechnology

2023-2024

23BECEOE06	Air and Noise Pollution and Control	3	0	0	3	40	60	100	215				
	COMPUTER SCIENCE AND EN	ollution and Control 3 0 0 3 40 60 100 214 IPUTER SCIENCE AND ENGINEERING s 3 0 0 3 40 60 100 214 s 3 0 0 3 40 60 100 214 s 3 0 0 3 40 60 100 214 g 3 0 0 3 40 60 100 214 g 3 0 0 3 40 60 100 214 nologies 3 0 0 3 40 60 100 214 g 3 0 0 3 40 60 100 224 g 3 0 0 3 40 60 100 224 g 3 0 0 3 40 60 100 224 g 3 0 0 3 40 60 100 224											
						1							
23BECSOE01	Internet of Things	3	0	0	3	40	60	100	217				
23BECSOE02	Machine Learning	3	0	0	3	40	60	100	219				
23BECSOE03	Blockchain Technologies	3	0	0	3	40	60	100	221				
23BECSOE04	Cloud Computing	3	0	0	3	40	60	100	223				
	COMPUTER SCIENCE AND ENGINE	ERIN	G (Cy	ber se	curity	·)	00	100	223				
23BECYOE01	Basics of Cyber crime and Cyber Security	3	0	0	3	40	60	100	225				
23BECYOE02	Basics of Cyber Forensics	3	0	0	3	40	60	100	227				
23BECYOE03	Cyber Laws and Intellectual Property Rights	3	0	0	3	40	60	100	229				
23BECYOE04	Blockchain and Cyber Security	3	0	0	3	40	60	231					
	ARTIFICIAL INTELLIGENCE & D	ATA S	CIEN	CE	-	_	-						
23BTADOE01	Fundamentals of Data Science	3	0	0	3	40	60	100	234				
23BTADOE02	Fundamentals Artificial Intelligence	3	0	0	3	40	60	100	236				
23BTADOE03	Internet Programming	3	0	0	3	40	60	100	238				
23BTADOE04	Robotics and Automation	3	0	0	3	40	60	100	240				
22REEE0E01	ELECTRICAL AND ELECTRON	ICS EN	IGINE	EERIN	G	T							
2386660601	Kenewable Energy Systems	3	0	0	3	40	60	100	242				
23BEEE0E02	Hybrid Electric Vehicles	3	0	0	3	40	60	100	244				
22000001	ELECTRONICS AND COMMUNICA	TION	ENG	INEEF	RING	1			0.14				
23BEECOE01	Real Time Embedded Systems	3	0	0	3	40	60	100	246				
23BEECOE02	Consumer Electronics	3	0	0	3	40	60	100	248				
	MECHANICAL ENGIN	EERI	NG										
23BEMEOE01	Battery Management System												
		3	0	0	3	40	60	100	250				
23BEMEOE02	Industrial Safety and Environment	3	0	0	3	40	60	100	252				
23BEMEOE03	Non-destructive Testing	3	0	0	3	40	60	100	254				
23BEMEOE04	Operations Research				2	40		100	254				
	SCIENCE AND HUM	<u>3</u>	<u> </u>	0	3	40	60	100	256				
23BTSHOE01	Mass Communication												
		3	0	0	3	40	60	100	258				

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore - 641 021

B.Tech. Biotechnology

2023-2024

23BTSHOE02	Fuzzy Mathematics								
25010110202		2	0	0	2	40	(0)	100	260
23BTSHOF03	Material Sciences	3	0	0	3	40	60	100	260
25015110205	Material Sciences	2	0	0		40	60	100	0.00
23BTSHOE04	Green Chemistry	3	0	0	3	40	60	100	262
25015110204	Green Chemisu y	2	0	0		40	60	100	0.05
E	ACULTY OF ADTS SCIENCE COMMED					40 ENT	60	100	265
	ACULI I OF ARTS, SCIENCE, COMMER			ANA	JEIVI		r		
23MBAPOE301	Organizational Behaviour	3	0	0	3	50	50	100	267
2201100E201	Matarial Characterization	2	0	0	2	40	60	100	269
25PHPOE501		3	0	0	3	40	00	100	
23PHPOE302	Numerical Methods and Programming	3	0	0	3	40	60	100	271
									274
23CAPOE301	Robotics Process Automation	3	0	0	3	40	60	100	271
23BCPOE301	Nutrition and Dietetics	3	0	0	3	40	60	100	276
2205000201		2	0	0	2	10	60	100	279
23CSP0E301	Cyber Forensics	3	0	0	3	40	60	100	
23CMPOE301	Personal Finance and Planning	3	0	0	3	40	60	100	281
									202
23CHEOE301	Chemistry In Everyday Life	3	0	0	3	40	60	100	203
23MBPOE301	Fermentation Technology	3	0	0	3	40	60	100	285
									287
23EGPOE301	English for Competitive Examinations	3	0	0	3	40	60	100	207
23BTPOE301	Sericulture	3	0	0	3	40	60	100	289
			0	0		10	60	100	292
23MMPOE301	Coding Theory	3	0	0	3	40	60	100	
	PHARMACY								
23BP804ET	Pharmaceutical Regulatory Science	4	0	0	4	25	75	100	294
23BP809ET	Cosmetic Science	4	0	0	4	25	75	100	296

S.No.	Course work-					Credits	Percentage				
	subject area	Ι	П	ш	IV	V	VI	VII	VIII	Total	(%)
1.	Humanities and Social Sciences (HS)	1	1							7	4.27
2.	Basic Sciences (BS)	3	2		1					24	15.24
3.	Engineering Sciences- Common (ES)	2	2	1	1					26	15.85
4.	Professional Subjects- Professional Core (PC)			4	3	3	4	3		65	39.63
5.	Professional Electives (PE)				1	2	1	2		18	10.98
6.	Open Electives (OE)						1	1		6	3.66
7.	Mandatory Courses (MC)	3	2	2	2	1	1			2	1.22
8.	Project Work, Seminar, Internship (PW)			1		1	1	1	1	15	9.15
	·			Total (Credit	S	·	·	·	163	100

23BTCC101

SEMESTER-I

PROFESSIONAL COMMUNICATIVE ENGLISH

3H-3C

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

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

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

COURSE OUTCOMES:

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

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

UNIT-1 Vocabulary Building

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

UNIT-2 Fundamentals of English Grammar

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

UNIT- 3 Language Skills (Reading and Writing)

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

UNIT-4 Professional Skills

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

9h

9h

9h

9h

UNIT -5 Interpersonal Skills

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

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

TEXT BOOKS

- 1. Raman. Meenakshi, Sharma. Sangeeta (2015). Technical Communication (Principles and Concepts) . Oxford university press. New Delhi.
- 2. Sanjay Kumar, Pushpalata, (2011), Communication skills, 1st Edition Oxford Press.

Reference Book

1. Ashraf Rizvi M, Effective Technical Communication, McGraw Hill Education, First Edition, 2013.

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	-	-	-	-	-	-	-	1	2	3	-	3	-	-
CO2	-	-	-	-	-	-	-	1	2	3	-	2	-	-
CO3	-	-	-	-	-	-	-	2	2	3	-	2	-	-
CO4	-	-	-	-	-	-	-	3	2	3	-	2	-	-
CO5	-	-	_	-	-	-	-	3	2	3	-	3	-	-
Avg.	-	-	-	-	-	-	-	2	2	3	-	2.4	-	-

2023-2024

Total:45

23BTCC102

MATRICES AND CALCULUS

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

SEMESTER-I 4H-4C

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

COURSE OBJECTIVES:

The goal of this course is for students:

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

COURSE OUTCOMES:

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

- 1. Make use of orthogonal transformation to reduce the quadratic form to canonical form.
- 2. Utilize differential calculus of multivariable to optimization problems.
- 3. Solve the nth order Ordinary Differential Equations(ODE) and Homogeneous equation of Euler's type.
- 4. Solve the nth order Partial Differential Equations.

UNIT – I MATRICES

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

UNIT – II DIFFERENTIAL CALCULUS OF MULTIVARIABLE FUNCTIONS 12h

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables - Jacobians - Partial differentiation of implicit functions - Applications: Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers.

12h

UNIT – III MULTIPLE INTEGRALS

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

UNIT – IV ORDINARY DIFFERENTIAL EQUATIONS 12h

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

UNIT – V PARTIAL DIFFERENTIAL EQUATIONS 12h

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

Total: 60h

TEXT BOOKS:

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

REFERENCE BOOKS:

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

WEBSITES:

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

CO PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	I	-	-	I	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	I	-	-	I	-	-	-	1	-	-
C05	3	2	1	_	-	-	-	-	-	-	-	1	-	-
Avg.	<u>3.0</u>	<u>2.0</u>	1.0	_	I	_	Ι	I	_	I	_	1.0	_	I

23BTCC103

SEMESTER-I

ENVIRONMENTAL STUDIES

3H-3C

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

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

COURSE OBJECTIVES:

The goal of this course is for students to:

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

COURSE OUTCOMES:

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

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

UNIT I INTRODUCTION - ENVIRONMENTAL STUDIES & ECOSYSTEMS 9h

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

UNIT II - NATURAL RESOURCES - RENEWABLE AND NON-RENEWABLE 9h RESOURCES

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

Levels of biological diversity - genetic, species and ecosystem diversity. Ecosystem and biodiversityservices: Ecological, economic, social, ethical, aesthetic and Informational value. Bio -geographical classification of India. Biodiversity patterns (global, National and local levels). Hot-spots of biodiversity. India as a mega-diversity nation. Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT IV -ENVIRONMENTAL POLLUTION

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

UNIT V - SOCIAL ISSUES AND THE ENVIRONMENT

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

Total: 45

TEXT BOOKS:

- 1. Anubha Kaushik., and Kaushik, C.P. 2004. Perspectives in Environmental Studies. New Age International Pvt. Ltd. Publications, New Delhi.
- 2. Erach Bharucha. 2004. A text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research, New Delhi.
- 3. Rajagopalan, R. 2016. Environmental Studies: From Crisis to Cure, Oxford University Press.
- 4. Sing, J.S., Sing. S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand & Publishing Company, New Delhi.

9h

2023-2024

9h

REFERENCE BOOKS

- 1. Mishra, D.D. 2010. Fundamental Concepts in Environmental Studies. S. Chand& Company Pvt. Ltd., New Delhi.
- 2. Arvind Kumar. 2004. A Textbook of Environmental Science. APH Publishing Corporation, New Delhi.
- 3. Singh, M.P., Singh, B.S., and Soma, S. Dey. 2004. Conservation of Biodiversity and Natural Resources. Daya Publishing House, New Delhi.
- 4. Tripathy. S.N., and Sunakar Panda. (2004). Fundamentals of Environmental Studies (2nd ed.). Vrianda Publications Private Ltd, New Delhi.
- 5. Verma, P.S., and Agarwal V.K. 2001. Environmental Biology (Principles of Ecology). S. Chand and Company Ltd, New Delhi.
- 6. Uberoi, N.K. 2005. Environmental Studies. Excel Books Publications, New Delhi.

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	2	3	3	-	1	-	2	2	-
CO2	2	1	-	-	-	2	3	3	-	1	-	2	2	-
CO3	2	1	-	-	-	2	3	3	-	1	-	2	2	-
CO4	2	1	-	-	-	2	3	3	-	1	-	2	2	-
CO5	2	1	-	-	-	2	3	3	-	1	-	2	2	-
Avg.	2	1	-	-	-	2	3	3	-	1	-	2	2	-

CO PO MAPPING

23BTBT141

ENGINEERING PHYSICS (THEORY &LABORATORY)

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

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3 Hours

(i)THEORY

Course Objectives

The goal of this course is for students to

- Inculcate the basics of properties of matter, sound and its applications.
- Understand the basics of laser and optical fiber with appropriate applications.
- Disseminate the fundamentals of thermal physics and their applications.
- Introduce the concepts of quantum mechanics for diverse applications.
- Impart the basic knowledge of crystal and its various crystal structures.

Course Outcomes

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

- 1. Identify the elastic properties of the materials using Young's modulus and rigidity modulus
- 2. Examine the performance of light, laser and optical fibres
- 3. Apply the concept of thermal properties for calculating thermal conductivity of the materials
- 4. Relate the quantum concepts in electron microscope
- 5. Outline the basics of crystals, structures and its defects

UNIT I – PROPERTIES OF MATTER

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

UNIT II – LASER AND FIBER OPTICS

LASER: Introduction - characteristics - Einstein's co-efficient derivation Principle of laser actionpopulation inversion- pumping methods -Types of laser - Nd: YAG, CO₂- Applications of LASER in industry and medicine. Fiber optics - principle– modes of propagation of light in optical fibers – numerical aperture and acceptance angle –types of optical fibers (Material, refractive index and mode) – fiber optical communication system (block diagram).

9h

SEMESTER-I 6H-5C

UNIT III – THERMAL PHYSICS

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

UNIT IV – QUANTUM PHYSICS

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

UNIT V – CRYSTAL PHYSICS

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

Total: 45

9h

(ii) LABORATORY

LIST OF EXPERIMENTS – PHYSICS (Any 7 Experiments)

- 1. Torsional pendulum Determination of rigidity modulus of wire and moment of inertia of disc
- 2. Uniform bending– Determination of young's modulus.
- 3. Non-uniform Bending Determination of young's modulus.
- 4. Viscosity of liquids-Determination of co-efficient of viscosity of a liquid by Poiseuille's flow.
- 5. Laser- Determination of the wave length of the laser using grating,
- 6. Optical Fiber Determination of Numerical Aperture and Acceptance angle of the optical fiber.
- 7. Air wedge Determination of thickness of a thin sheet/wire.
- 8. Lee's disc Determination of thermal conductivity.
- 9. Determination of Band gap of a semiconductor.
- 10. Characteristics of photo diode.

TOTAL : 30

9h

9h

10

- 2. Gaur R.K. and Gupta S.L, Engineering Physics, Dhanpat Rai Publications, 2012.
- 3. Pandey. B.K. & Chaturvedi. S, Engineering Physics, Cengage Learning India, 2012.
- 4. Charles Kittel, Kittel's Introduction to Solid State Physics, Wiley India Edition, 2019.
- 5. P.M. Mathews, K.Venkatesan, A text book of Quantum Mechanics, 2/e, Mc Graw Hill Education, 2017.
- 6. Laser Fundamentals, William T Silfvast, Cambridge Univ Press. 2012.
- 7. Fiber Optics and Optoelectronics, R P Khare, Oxford, 2012.

REFERENCES:

- 1. Halliday.D. Resnick R. & Walker. J, Principles of Physics, Wiley, 2015.
- 2. Daniel V.Schroeder, An Introduction to Thermal Physics, Pearson, 2014.

WEBLINKS:

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

CO PO MAPPING

CO No	DO1	DOI	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO
CONO	POI	PO2	3	4	5	6	7	8	9	0	1	2	1	2
CO1	3	2	1	-	-	-	-	-	2	2	-	1	-	-
CO2	3	3	2	-	-	1	-	-	2	2	-	1	-	-
CO3	3	2	-	-	-	-	-	-	2	2	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	1	-	1	-	-
Avg.	2.6	1.8	1.5	-	-	1.0	-	-	2.0	1.6	-	1.0	-	-

23BTCC142

PROGRAMMING IN C (THEORY &LABORATORY)

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

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

(i) THEORY

COURSEOBJECTIVES:

The goal of this course is for the students to

- Interpret problem solving using C.
- Apply the concept of arrays and strings.
- Identify the functions of C Language.
- Apply the concept of pointers.
- Develop C Programs using user defined function and file handling.

COURSE OUTCOMES:

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

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

UNIT I INTRODUCTION

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

UNIT II ARRAYS AND STRINGS

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

UNIT III FUNCTIONS

Functions - Types of Functions - Function prototypes - Function definition - Function call including passing arguments by value and passing arguments by reference - Passing arrays to

9h

9h

9h

SEMESTER-I 6H-5C functions - Math library functions - Recursive functions - Scope rules (local and global scope) - Storage classes in C.

UNIT IV POINTERS

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

UNIT V USER DEFINED TYPES AND FILE HANDLING 9h

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

Total :45

(ii) LABORATORY

LIST OF EXPERIMENTS:

- 1. Develop a C Program to find the roots of quadratic equation for non-zero coefficient using if-else ladder construct.
- 2. Develop Programs using simple control statements such as if else, while, do while. Example Extracting the digits of an integer, reversing digits, finding sum of digits
- 3. Develop a C Program to implement a simple calculator to perform addition, subtraction, multiplication and division operations using switch construct. Display appropriate messages for invalid operator and divide by zero error.
- 4. Develop C Program to generate Fibonacci sequence, calculation of factorials, printing various patterns and generate the Prime numbers between the ranges m & n using for loop.
- 5. Develop a C program to read n elements into an integer array, Insert and Delete element from the array.Print the input array and the resultant array with suitable messages.
- 6. Develop a C program to read two matrices A (m x n) and B (p x q) and compute the product of the two matrices. Print both the input matrices and resultant matrix with suitable headings and output should be in matrix format only. Program must check the compatibility of orders of the matrices for multiplication. Report appropriate message in case of incompatibility.

- 7. Develop a C function Program to sort the given names in Asecuding Order.
- 8. Develop a C program to count the vowels & consonants in a given string.
- 9. Develop a C Program to find the GCD of two integers using Euclid's algorithm
- 10. Develop a recursive C function to find the factorial of a number, n!, defined by fact (n)=1, if n=0. Otherwise fact(n)=n*fact(n-1). Using this function, develop a C program to compute the Binomial coefficient nCr. Perform input validation as well.
- 11. Develop a C program to find the smallest and largest elements in an array using pointers and then swap these elements and display the resultant array.
- 12. Develop a C program to find the sum of all the elements of an integer array using pointers.
- 13. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using structures and pointers

TOTAL : 30

TEXTBOOKS:

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

REFERENCES BOOKS:

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

WEBSITES:

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

CO-PO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	2	2	-	2	2	3
CO 2	3	2	1	-	-	-	-	-	2	2	-	2	2	3
CO 3	3	2	1	-	-	-	-	-	2	2	-	2	2	3
CO 4	3	3	2	1	-	-	-	-	2	2	-	2	2	3
CO 5	3	3	2	1	-	-	I	-	2	2	-	2	2	3
Avg.	3	2.4	1.4	1	-	-	-	-	2	2	-	2	2	3

23BTCC111

ENGINEERING GRAPHICS

4H-3C

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

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students to:

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

COURSE OUTCOMES:

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

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

UNIT I INTRODUCTION

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Bureau of Indian Standards (BIS), Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice geometric constructions, principles of dimensioning–linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension. Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and Vernier Scale. Conic sections including the Ellipse, Parabola and Hyperbola (eccentricity method only); Cycloid, Epicycloid, Hypocycloid and Involute.

UNIT II FREE HAND SKETCHING

Representation of Three-Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views

9h

- Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT III INTRODUCTION TO COMPUTER GRAPHICS – 2D 9h

Overview of Computer Graphics, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software, Consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Annotations, layering and other functions. Sketching of 2D simple geometries, editing and dimensioning of 2D geometries.

UNIT IV PROJECTION OF POINTS AND LINES

Projection of points and straight lines located in the first quadrant inclined to both planes– Determination of true lengths and true inclinations (By using CAD software).

UNIT V PROJECTION OF PLANE SURFACES

Projection of polygonal surface and circular lamina inclined to both reference planes (By using CAD software).

Total: 45h

TEXT BOOKS:

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

REFERENCE BOOKS:

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

17

9h

WEBSITES:

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

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	1	-	2	-	2	2	-
CO2	3	2	-	-	-	-	-	1	-	2	-	2	2	-
CO3	3	2	-	-	-	-	-	1	-	2	-	2	2	-
CO4	3	2	-	-	-	-	-	1	-	2	-	2	2	-
CO5	3	2	2	1	-	-	-	1	-	2	-	2	2	-
Avg.	3	2	2	1	-	-	-	1	-	2	-	2	2	-

23BTCC111

DESIGN THINKING

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

Course objectives:

The goal of this course is for the students to

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

Course outcomes:

Upon completion of the course, students will be able to

- 1. Outline design thinking for product development using design thinking tools
- 2. Identify the need for customer requirements and types of users
- 3. Analyze the various stages of prototype development
- 4. Experiment with the different categories of product and service design
- 5. Apply design thinking to improve on existing products and design innovative products.

UNIT -I INTRODUCTION

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

UNIT- II EMPATHISE WITH USERS

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

UNIT-III PROTOTYPING

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

UNIT-IV PRODUCT AND SERVICE DESIGN 6h

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

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

SEMESTER-I

2H - 2C

6h

6h

UNIT -V DESIGN AND INNOVATION 6h

DT For strategic innovations - Extreme Competition - Experience design - Standardization - Humanization - Creative Culture.

Total :30 h

TEXT BOOKS

- 1. Bala Ramadurai, "Karmic Design Thinking", 2020.
- 2. Christian Mueller-Roterberg, "Handbook of Design thinking", Amazon Digital ServicesLLC KDP Print US, 2018.
- 3. Tim Brown, "Change by Design", Harper Business Publisher, 2019

REFERENCE BOOKS

- 1. Hasso Plattner, Christoph Meinel and Larry Leifer, "Design Thinking: Understand Improve – Apply", Springer, 2011
- 2. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You atBusiness or Design School", John Wiley & Sons 2013.

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	2	1	-	-	1	1	2	1	-	2	-	-
CO2	-	-	2	1	-	-	1	1	2	1	-	2	-	-
CO3	-	-	2	1	-	-	1	1	2	1	-	2	-	-
CO4	-	-	2	1	-	-	1	1	2	1	-	2	-	-
C05	-	-	2	1	-	-	1	1	2	1	-	2	-	_
Avg.	-	-	2	1	-	-	1	1	2	1	-	2	-	-

CO-PO MAPPING

20

SEMESTER - I SPORTS AND YOGA

23BTMC151

1H-0C

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

Marks: Internal:100 External:0 Total:100

COURSE OBJECTIVES:

The goal of this course, is for the students:

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

COURSE OUTCOMES:

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

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

UNIT – I INTRODUCTION TO PHYSICAL FITNESS

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

UNIT – II FUNDAMENTALS OF ANATOMY & PHYSIOLOGY IN SPORTS & YOGA

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

UNIT-III YOGA & PRANAYAMA

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

TEXT BOOKS

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

REFERENCE BOOKS

- 1. AcharyaYatendra, Yoga and Stress Management, Finger print Publishing ISBN:938905303X
- 2. Swami Vivekanand, Patanjali Yoga Sutras, Fingerprint Publishing
- 3. Ramdev, Pranayam Rahasya, Patanjali Divya Prakashan, Haridwar
- 4. Ramdev, Yoga its Philosophy & Practice, Divya Prakashan, Haridwar.

23BTMC152

பருவம் -I

தமிழர் மரபும் பண்பாடும்

1H-0C

கற்பித்தல் நேரம்/வாரம்: L:1 T:0 P:0

மதிப்பெண்: இடைத்தேர்வு: 100 மொத்தம்:0

பாடத்திட்ட பயன் விளைவு:

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

பாடத்திட்டப் பொதுநோக்கம்:

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

அலகு:1 தமிழர்மரபு

மரபு – விளக்கம் – சங்ககால தமிழர் மரபு – திணைப்பகுப்பும் தமிழர் மரபும் -உலகப் பொதுமை – அகத்திணை மரபு – புறத்திணைமரபு-இடைக்காலத்தமிழர்மரபு – பிற்காலமரபும்மாற்றமும் – தற்காலதமிழர்மரபு - வளர்ச்சி.

அலகு: 2 தமிழர்பண்பாடு

பண்பாடு – விளக்கம் – பழந்தமிழர்பண்பாடு – இயற்கைசார்ந்தவாழ்வியல் – தமிழர்சமயம் – அரசியல்நிலை– சமூகப்பழக்கவழக்கங்கள் – நம்பிக்கைகள் – வாழ்வியல்அறங்கள் – வணிகம்போன்றவை.

அலகு:3 தமிழர் கலைகள்

தமிழகத்தில்கலைகளின்வளர்ச்சி – சிற்பக்கலைவளர்ச்சி –கோயில்கலை – கற்கோவில்கள் - ஓவியக்கலை – அழகுக்கலைகள் - கூத்துக்கலை – மருத்துவக்கலை – நாடகக்கலை– இசைக்கலைபோன்றவை.

அலகு: 4 தமிழர் சமயம்

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

அலகு: 5 இலக்கியங்களில் தமிழர் பண்பாட்டுப்பதிவுகள்

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

பார்வை நூல்கள்:

- தமிழ் இலக்கிய வரலாறு தமிழண்ணல், மீனாட்சி புத்தக நிலையம்-மதுரை-இரண்டாம் பதிப்பு-ஜூலை – 2000.
- தமிழர் நாகரிகமும் பண்பாடும், அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், சென்னை, திருத்திய பதிப்பு – 2022.

- தமிழர் வரலாறும் பண்பாடும், நா. வானமாமலை, நியூ செஞ்சுரி புக்ஹவுஸ், சென்னை, ஆறாம் பதிப்பு - 2007.
- தமிழக வரலாறுமக்களும் பண்பாடும், கே.கே. பிள்ளை, உலகத் தமிழராய்ச் சிநிறுவனம், சென்னை.

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

The goal of this course is for students to

Make the students to understand the concept of periodic function and represent them in

TRANSFORMS AND ITS APPLICATIONS

• Make the students to understand the applications of partial differential equations.

Provide knowledge about solving ordinary differential equations using the Inverse

Acquaint the students with the concepts of Fourier transform techniques.Impart knowledge in Laplace transform techniques and its applications.

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

- 1. Illustrate Fourier series representation of periodic functions.
- 2. Apply the physical significance of Fourier series techniques in solving one dimensional heat flow problems and one-dimensional wave equations
- 3. Extend the concept of Fourier series to non-periodic functions as Fourier transforms.
- 4. Infer the knowledge of Laplace transformation techniques to convert time-domain complex systems into simple frequency-domain algebraic equations.
- 5. Apply inverse Laplace transform techniques for solving linear differential equations.

UNIT I FOURIER SERIES

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

UNIT II: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12h

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

UNIT III FOURIER TRANSFORMS

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

COURSE OBJECTIVES:

Fourier series.

Laplace transform.

COURSE OUTCOMES:

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

Semester-II

4H-4C

12h

UNIT IV LAPLACE TRANSFORM

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

UNIT V INVERSE LAPLACE TRANSFORM

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

Total :60h

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Web URL:

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

12h

12h

27

CO PO MAPPING:

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	-	-	_	_	-	-	-	-	1	_	-
Avg.	2.8	1.8	1	-	-	-	-	-	-	-	-	1	-	-

2023-2024

23BTBT202

BIOPHYSICS

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

3H-3C

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

COURSE OBJECTIVES

The goal of this course is for students to:

- Introduce the Students to the fundamental concepts of physics applicable in biological systems.
- Inculcate the basics of biomolecules such as lipids, fats and oils nucleic acids, amino acids and proteins.
- Study the concepts of light and its optical principle.
- Understand the various spectroscopic techniques for studying the properties of biomolecules
- Study the fluid properties and the fluid relation with blood vessels and its effect.

COURSE OUTCOMES

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

- 1. Explain the basics of biomolecules and its types
- 2. Outline the concept of light in optical microscope
- 3. Identify the biomolecules using UV-Visible, IR and NMR spectroscopy.
- 4. Relate the properties of fluid flow in blood vessels
- 5. Illustrate the process of radiation traces and its harmful effects

UNIT I – BIOMOLECULES

Introduction to biomolecules, Structure and function of mono, di, oligo and polysaccharides-Nucleic acids: biophysics of RNA and DNA- Amino acids: Amino acid general structure & types - Proteins: Structure of Proteins - primary, secondary, tertiary and quaternary - Lipids, types of lipids, fatty acids, Fats & oils, Phospholipids, Glycolipids; lipoproteins, Molecular confirmation – docking theory, Ramachandran plot.

UNIT II - LIGHT AND OPTICS

Physics of light, Reflection, Refraction, absorption and scattering – Basics of lenses, Interference phenomena, Refractometry : Refraction of light, principle ,design, working and application of Abbe's refractometer, Human eye- limits of vision and color vision - Light microscopy: Simple, compound optical microscope, Polarimetry: Polarization of light, optical activity and its measurement.

9h

B.Tech. Biotechnology

UNIT III – SPECTROSCOPY TECHNIQUES

Interaction of electromagnetic radiation with Matter: electromagnetic spectra - regions of spectrum - numerical - Introduction to spectroscopy: UV-Visible, IR and NMR - Spectrometric Instrumentation of UV-Visible, IR and NMR: sources, monochromators, sample cells, detectors -Spectrometric applications to biomolecule: Quantitative analysis using the Lambert - Beer's Law.

UNIT IV – FLUIDS

Physical properties of fluids - specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure - Reynolds number - Determination of coefficient of viscosity by Poiseuille's method - Oswald viscometer - Buoyancy and floatation - Bernoulli's equation - fluid flow in constricted tube – blood flow through a blood vessel with a partial blockage – angioplasty.

UNIT V – RADIATION

Absorption of radiation by body tissues - damage effect of neutrons - radiation measurement & units: expose, absorbed dose, stopping power - Radiation detection and measurements -Radioactive tracers - labeling with isotopes - stable radioactive isotopes - application of traces dosimetry - relative biological effectiveness (RBE) - DNA mutation.

Total: 45 H

TEXT BOOKS:

- 1. P. Nelson, Biological Physics: Energy, information, life, Freeman, 1st edition (2013).
- 2. Rodney M.J. Cotterill, Biophysics: An Introduction, Wiley, Ist Edition (2002).
- 3. R. Glaser, Biophysics: An introduction, Springer, 2nd Edition (2012).
- 4. Mae-Wan Ho, The rainbow and the worm: The physics of organisms, World scientific publishing, 3rd edition (2008).

REFERENCES:

- 1. Biochemistry. 5th edition. Berg JM, Tymoczko JL, StryerL.New York: W H Freeman; (2002).
- 2. Gerhart Friedlander, Joseph W. Kenedy, Ed Ward S. Macias and J.M. Miller Jones, "Nuclear and Radiochemistry", Wiley & Sons Ltd (2013).

WEBSITES:

- 1. www.nptel.ac.in/courses/104102009/.
- 2. www.nptel.ac.in/content/syllabus/104102009.

CO PO MAPPING:

9h

9h

CO. NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	1	-	1	-	1
CO2	2	1	-	-	-	-	-	-	-	1	-	1	-	1
CO3	3	2	1	-	-	1	-	1	-	1	-	1	-	1
CO4	2	1	-	-	-	1	-	1	-	1	-	1	-	1
CO5	2	1	-	-	-	1	-	1	-	1	-	1	-	1
Avg.	2.2	1.2	1.0	-	-	1.0	-	1.0	-	1.0	-	1.0	-	1

23BTBT241

ENGINEERING CHEMISTRY (THEORY & LABORATORY)

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

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3 Hours

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for students to

- Learn the basics of Periodic properties, Intermolecular forces
- Infer the terminologies of electrochemistry and to analyze about energy storage devices
- Build the concept of corrosion and its prevention
- Summarize the basic water technology and its purification.
- Develop an understanding of the range and uses of analytical methods in chemistry

COURSE OUTCOMES:

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

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

UNIT I - PERIODIC PROPERTIES, INTERMOLECULAR FORCES 9h

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

UNIT II ELECTROCHEMISTRY AND STORAGE DEVICES

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

UNIT III CORROSION AND ITS CONTROL

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

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32

2023-2024

SEMESTER-II

6H-5C

9h

coating - Hot dipping

UNIT IV – WATER TECHNOLOGY

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

UNIT V - SPECTROSCOPIC TECHNIQUES AND APPLICATIONS 9h

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

Total: 45h

33

(ii) LABORATORY

Choice of 10 experiments from the following:

- 1. Determination of surface tension and viscosity
- 2. Determination of Sodium Carbonate and Sodium Hydrogen Carbonate in a mixure using volumetric titration
- 3. Determination of Ca / Mg using complexometric titration
- 4. Thin layer chromatography
- 5. Determination of chloride content of water
- 6. Determination of the rate constant of a reaction
- 7. Conductometry Determination of cell constant and conductance of solutions
- 8. pH Metry Determination of Acid / Base
- 9. Potentiometry determination of redox potentials and emfs
- 10. Saponification/acid value of an oil
- 11. Determination of the partition coefficient of a substance between two immiscible liquids
- 12. Adsorption of acetic acid by charcoal
- 13. Use of the capillary viscometers to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

2023-2024

TEXT BOOKS

- 1. P C Jain & Monica Jain, (2015). Engineering Chemistry, 18th edition, Dhanpat Rai Publishing Company
- 2. B. H. Mahan, (2010). University chemistry, Pearson Education.
- 3. M. J. Sienko and R. A. Plane,(1976) Chemistry: Principles and Applications. 5th edition, McGraw-Hill Higher Education.

REFERENCE BOOKS

- 1. C. N. Banwell, (2001) Fundamentals of Molecular Spectroscopy, McGraw-Hill.
- 2. B. L. Tembe, Kamaluddin and M. S. Krishnan, Engineering Chemistry (NPTEL Web-book)
- 3. P. W. Atkins, (2009). Physical Chemistry, Oxford University Press.
- 4. K. P. C. Volhardt and N. E. Schore, (2014).5th Edition, Organic Chemistry: Structure
- 5. and Function, W.H. Freeman Publications.

СО	PO	MAPPING:
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CO. NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	1	1	1	1	1	-	1	-	-
CO2	3	2	1	1	-	1	1	1	1	1	-	1	-	-
CO3	2	1	-	-	-	1	1	1	-	1	-	1	-	-
CO4	3	2	1	1	-	1	1	1	1	1	-	1	-	-
CO5	2	1	-	-	-	1	1	1	-	1	-	1	-	-
Avg.	3	3	2	1	-	1	1	1	1	1	-	1	-	-

23BTCC242

Semester-II

2023-2024

BASIC ELECTRICAL & ELECTRONICS ENGINEERING 5H-4C

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

Marks:Internal:40External:60Total:100

End Semester Exam: 3 Hours

(i) THEORY

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

UNIT I - DC CIRCUITS

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

UNIT II - AC CIRCUITS

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

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9h

9h

9h

UNIT III - ELECTRICAL MACHINES AND TRANSFORMER

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

UNIT IV- SEMICONDUCTOR DEVICES AND DIGITAL ELECTRONICS 9h

Bipolar Junction Transistor – Characteristics. Introduction to operational Amplifier –Model– Applications. Number systems – binary codes - logic gates - Boolean algebra, laws & theorems

UNIT V- MEASURING INSTRUMENTS AND ELECTRICAL INSTALLATION 9h

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

Total: 45 h

(ii)LABORATORY

LIST OF EXPERIMENTS

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

TEXT BOOKS:

- 1. S.K.Bhattacharya, "Basic Electrical Engineering", Pearson, 2019.
- 2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
- 3. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010

REFERENCE BOOKS

- 1. VN Mittle and Arvind Mittal, (2006), Basic Electrical Engineering, McGraw Hill.
- 2. A.Sudhaka and Shyammohan S Palli, (2013), Circuits and Networks, McGraw Hill.
- 3. R.Muthusubramanian and S.Salivahanan, (2014), Basic Electrical and Electronics Engineering, McGraw Hill.

WEB SITES:

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

CO-PO MAPPING

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

23BTCC243B

SEMESTER-II 6H-5C

OBJECT ORIENTED PROGRAMMING WITH PYTHON (THEORY & LABORATORY)

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

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

9h

9h

9h

2023-2024

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students:

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

COURSE OUTCOMES:

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

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

UNIT I - PYTHON FUNDAMENTALS

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

UNIT II - DATA STRUCTURES IN PYTHON

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

UNIT III - FUNCTIONS AND MODULES

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

UNIT IV - CLASSES AND OBJECTS

9h

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

UNIT V - INHERITANCE, POLYMORPHISM AND EXCEPTION HANDLING 9h

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

(ii) LABORATORY

LIST OF EXPERIMENTS:

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

TEXT BOOKS:

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

REFERENCES BOOKS:

- 1. The Absolute Beginner's Guide to Python Programming, Kevin Wilson, Apress Media LLC, First Edition, 2022.
- 2. Python 3 The Comprehensive Guide, Johannes Ernesti, Peter Kaiser, Rheinwerk

Publishing Inc., First Edition, 2022

3. Fundamentals of Python Programming, Richard L. Halterman, Southern Adventist University, First Edition, 2019

WEBSITES:

- 1. https://docs.python.org/3/
- 2. https://www.programiz.com/python-programming
- 3. <u>https://www.scaler.com/topics/python/</u>
- 4. https://www.geeksforgeeks.org/python-oops-concepts/

CO-PO MAPPING

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	2	2	-	2	-	-
CO2	3	2	1	-	-	-	-	-	2	2	-	2	-	-
CO3	3	2	1	-	-	-	-	-	2	2	-	2	-	-
CO4	3	2	1	-	-	-	-	-	2	2	-	2	-	-
CO5	3	3	2	1	-	-	1	-	2	2	-	2	-	-
Avg.	3	2.2	1.2	1	-	-	-	-	2	2	-	2	-	-

SEMESTER-II

23BTMC251

SOFT SKILLS

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

1H - 0C Marks: Internal:100 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

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

COURSE OUTCOMES:

Upon completion of this course the students will be able to

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

Unit-I Communication Skills

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

Unit-II Critical Thinking

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

Unit -III Problem Solving & Decision Making

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

Text Books

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

SEMESTER-II

23BTMC252

WOMEN SAFETY AND SECURITY

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

1H - 0C

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

COURSE OBJECTIVES:

The goal of this course is for the students to

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

COURSE OUTCOMES:

Upon completion of this course the students will be able to

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

Unit I: Fundamental Concepts of Women's Studies

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

Unit II: Social Empowerment

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

Unit III: Political Empowerment

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

TEXT BOOKS

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

SEMESTER III

23BTBT301	Principles of Ch	nemical Engineering	4H-4C
Instruction Hours/week:	L:3 T:1 P:0	Marks: Internal:40 Exter	nal:60 Total:100
		End Semeste	r Exam: 3 Hours

Course Objectives

The goal of this course is for students to

- Understand the basic laws and concepts of chemical calculations.
- Explain the principles and application of first and second laws of thermodynamics.
- Explain the overall material balances of chemical reactions and its basic calculations.
- Understand the fluid transportation.
- Discuss the fluid flow mechanics and its concepts.
- Apply the fluid mechanism principles in chemical engineering

Course Outcomes

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

- 1. Recall the basic chemical calculations and the basic laws governing it.
- 2. Illustrate basic laws of thermodynamics.
- 3. Infer the overall material balances of chemical reactions and its basic calculations.
- 4. Summarize the application of fluid flow mechanics in chemical engineering.
- 5. Outline the fluid flow and its measurements.

UNIT I - BASIC CHEMICAL CALCULATIONS

SI units, stoichiometry, basic chemical calculations: Ideal gas law- Ideal mixtures and solutions – Dalton's law of additive volumes, Henry's law, Raoult's law, Concepts of Simpson's rule and their applications to different systems. Effect of temperature on vapor pressure. Vapor pressure of miscible and immiscible solutions and liquids.

UNIT II - MATERIAL BALANCES

Overall and component balances, material balances without and with chemical reactions, tie substance - Limiting reactant; degrees of freedom, steady and unsteady state, unit operations, Combustion of coal, fuel gasses and sulphur recycling operations and by passing streams, selectivity and yield.

10h

UNIT III – UNIT OPERATION

Units and dimension, Dimensional analysis, Dimensional less numbers, Mixing and agitation, dimensional analysis, Filtration -types, filter media, selection of medium, filter aids-filter theory, Concepts and principles of sedimentation, settling velocity; centrifugation: Principles, types; Evaporators: Single effect and multiple effect.

UNIT IV - FLUID MECHANICS

Fluids: properties and types; Continuity equation; bernoulli's equation, fluid staticsand fluid dynamics; applications in chemical engineering; Fluid flow: laminar; Turbulent, pressure drops in flow pipes; compressible fluid flow concepts; multiphase flow concepts.

UNIT V - TRANSPORTATION OF FLUIDS

Pumps-types, working principle, Characteristics, Suction and Cavitation; Measurements of flowing fluids; Fluidization and flow through Packed Bed Column.

Total: 50 h

Text Books:

- Paulin M. Doran (2013). Bioprocess Engineering Principles. Second edition, Academic press, 1.
- 2. McCabe. W., Smith. J., and Harriott. P. (2004). Unit Operations of Chemical Engineering. 7th Edition. Tata McGraw Hill Education.
- Geankoplis C.J. (2016). Transport Processes and separation process principles.(Includes unit 3. operations). 4th Edition, Pearson.

Reference Books:

1. Smith. J.M., Van Ness H.C. and Abbot. M.M. Chemical (2001). Engineering Thermodynamics. McGraw-Hill.

2. Narayanan. K.V. (2001). A Text Book of Chemical Engineering Thermodynamics. Prentice Hall India.

3. Bansal R. K., (2015). Fluid Mechanics and Hydraulic Machines, Laxmi publications, Ninth Edition.

Web Links

1. https://archive.nptel.ac.in/courses/103/103/103103165/

10h

10h

10h

CO-PO Mapping

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
C01	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO4	2	1	-	-	-	1	-	-	-	-	-	-	2	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	2	1
Avg.	2	1	-	-	-	1	-	-	-	-	-	-	2	1

2023-2024

23BTBT302

Molecular Biology and Genetics

Semester-III 3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Outline the classical genetics concepts of eukaryotes and prokaryotes.
- Explain the structure of nucleic acids and DNA replication.
- Understand the molecular process of transcription.
- Understand the basic machinery of translation and its mechanisms.
- Understand the regulation of gene expression and various types of mutation
- Understand the synthesis of RNA and post-transcriptional modifications

Course outcome

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

- 1. Discuss the concepts related to eukaryotic and prokaryotic genetics.
- 2. Identify the structure of nucleic acids, DNA replication and chromosome organization.
- 3. Illustrate the prokaryotic and eukaryotic transcription, and its post transcriptional modifications.
- 4. Outline the concept of genetic code, translation process and post translational modifications.
- 5. Analyze the process of regulation of gene expression and its importance.

UNIT I - CLASSICAL GENETICS

Prokaryotic genetics - Bacterial conjugation, transduction and transformation. Chromosomal validation. Eukaryotic genetics - Gene interaction, Complementation linkage, Recombination and chromosomal mapping, crossing over, classical experiments – Hershey and Chase, Avery McLeod & McCarty.

UNIT II - STRUCTURE OF NUCLEIC ACIDS AND DNA REPLICATION 9h

Molecular structure of genes and chromosomes, Models of DNA, Features of Watson & Crick model, Replication in prokaryotes, D-loop and rolling circle mode of replication, replication of linear viral DNA. Regulation of replication, Inhibitors of replication. Organization of chromosome; genes; Cot value, replication of telomeres in eukaryotes. DNA damage and repair mechanisms.

UNIT III – TRANSCRIPTION

Conformation of RNA- Prokaryotic and Eukaryotic transcription, RNA polymerase, Transcription: Initiation, transcription factors, Inhibitors of transcription, Features of promoters and enhancers,

9h

ribozymes. Post transcriptional modification – 5' capping, polyadenylation, splicing, processing of mRNA, rRNA and tRNA, RNA editing, Regulators- SiRNA, mRNA.

UNIT IV – TRANSLATION

Genetic code, Salient features - Wobble hypothesis, basic machinery of translationprokaryotes and eukaryotes, protein folding, codon usage, Inhibitors of translation, post translational modifications, Glycosylation, methylation, -----, protein targeting.

UNIT V - REGULATION OF GENE EXPRESSION

Principles of gene regulation – suppressor, activators, co suppressor, moderator, silencer, enhancer, Operon concept- Lac operon, ara operon and trp operon, Mutation – types, transition, transversion, artificial & natural mutation, suppressor mutation; RNA interference technology.

Total: 45 h

Text Books:

1. Watson. J.D., Baker Bell, Gann, Levine and Losick. (2004). Molecular Biology of the Gene. Pearson Education.

2. Benjamin. L. (2004). Gene XII, 2018. Pearson Education.

Reference Books

1. Alberts B., Johnson A, Lewis J, Morgan D, Raff M, Roberts K and Walter P., Molecular Biology of the Cell, 6th Edition, Garland Science Publisher, New York, (2014). ISBN:9780815344322.

2. Weaver. R.F. (2005). Molecular Biology. Mc Graw Hill.

Web Links

1: https://www.sciencedirect.com/journal/journal-of-molecular-biology/vol/435/issue/17 /

2: https://academic.oup.com/mbe/issue/40/7

3: https://www.springer.com/journal/11008

CO-PO Mapping

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	3	1
Avg.	2.2	1.2	1	-	-	-	-	-	-	-	-	1	2.2	1

9h

23BTBT341 Biochem

Semester-III 5H-4C

Biochemistry (Theory & Lab)

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

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

9h

9h

i) Theory

Course Objectives

The goal of this course is for students to

- Outline the basics of biochemistry.
- Explain the structure and properties of carbohydrates and lipids.
- Illustrate the structure and properties of amino acids, proteins and nucleic acids.
- Discuss the metabolism of carbohydrates and lipids & its associated genetic disorders.
- Summarize the amino acid and nucleic acid metabolism and its associated genetic disorders.

Course Outcomes

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

- 1. Apply the basics of biochemistry and solve the basic calculations.
- 2. Identify the different forms of carbohydrates & lipids and its properties.
- 3. Experiment with various techniques for the analysis of biomolecules amino acids and nucleic acid.
- 4. Summarize the carbohydrate and lipid metabolism and its associated genetic disorders.
- 5. Outline the amino acids and nucleic acid synthesis and its degradation pathways.

UNIT I INTRODUCTION TO BIOCHEMISTRY

Introduction to Biochemistry, weak acid and bases, pH, buffers, pKa, Henderson, Hasselbalch equation, physiological buffers in living systems, Energy in living organism. Properties of water and their applications in biological systems.

UNIT II STRUCTURE AND PROPERTIES OF BIOMOLECULES-CARBOHYDRATES AND LIPIDS

Carbohydrates- Definition, types, classification. Aldose, Ketose, epimers, anomers, Haworth formula, sugars as reducing agents; Monosaccharides: pyronoses, furanoses, conformation of pyranoses; Disaccharides: Glycosidic bonds, hydrolysis, Polysaccharides: homopolysaccharides and heteropolysaccharides, Glycoconjugates: Glycoproteins, proteoglycan, and glycolipids; Methods of carbohydrate analysis; Fatty acids: Saturated and unsaturated fatty acids, TAG, saponification, iodination, hydrogenation, phospholipids, glycolipids, sphingolipids, steroid derivatives, cholesterol, prostaglandins. structural lipids in membrane. Fluid mosaic model, lipid extraction.

UNIT III STRUCTURE AND PROPERTIES OF BIOMOLECULES - PROTEINS AND NUCLEIC ACID

9h

General structure of amino acid, properties, classification of aminoacids by R group, Zwitterion. Peptides: Peptide bond, polypeptides. Proteins: hierarchy, primary, secondary, tertiary and quaternary four levels of structure in protein, Ramchandran Plot. Nucleotides and nucleic acid nomenclature, Phosphodiesterase Linkage, structure of purine and pyrimidine, nucleoside, RNA, DNA models.

UNIT IV - METABOLISM OF CARBOHYDRATES AND LIPIDS 9h

Major pathways of glucose utilization: Glycolysis, HMP pathway; TCA cycle; Electron transport chain. Biosynthesis of fatty acid. The α , β - oxidation pathway. Oxidation of monounsaturated and polyunsaturated fatty acid. Metabolic disorders in fatty Acyl–CoA dehydrogenases.

UNIT V - METABOLISM OF AMINO ACIDS AND NUCLEIC ACIDS 9h

Biosynthesis of amino acids from acetyl CoA, Biosynthesis of essential amino acids, Urea cycle. Pathways of degradation of aromatic, glucogenic and ketogenic amino acids. Inborn errors of amino acid metabolism. Biosynthesis of nucleotides, *de novo* and salvage synthesis pathways for purines and pyrimidines, regulatory mechanisms; catabolism of purine & pyrimidine; Metabolic disorders associated with biomolecules- Carbohydrate, Amino acid and Lipids.

Total: 45 h

ii) Laboratory

List of experiments

- 1. Preparation of stock solutions and buffers.
- 2. Qualitative tests for carbohydrates distinguishing reducing from non-reducing sugars and keto from aldo sugars.
- 3. Test and Quantification of Cholesterol (Zak's method)
- 4. Quantification of proteins by Lowry's method
- 5. Quantification of proteins by Bradford's method
- 6. Quantification of glucose by Anthrone method
- 7. Quantification analysis of amino acids
- 8. Estimation of DNA (DPA method)
- 9. Estimation of RNA (Orcinol method) /spectrometric method for quantification

Total: 30 h

Text Books

- Nelson. D.L., Cox. M., and Cox. M.M. (2017). Lehninger Principles 1 ofBiochemistry. 7 Edition Freeman W.H. & Company, New York.
- 2. Zubay. G.L. (2017). Principles of Biochemistry. Medtech.

Reference Books

- 1. Pedersen SH (2021). Reviews of Physiology, Biochemistry and Pharmacology 178 (Doctoral dissertation, Department of Biomedical Sciences, University of Copenhagen).
- 2. Murray. R.K., Granner. B.K., Mayes. P.A. and Rodwell. V.W. (2018). Harper's Illustrated Biochemistry, 31st edition, McGraw-Hill Education.
- 3. Voet. G. and Voet. A. (2018). Fundamentals of Biochemistry. 2nd Edition. John Wiley &Sons, Inc.

Web Links

- 1. https://nptel.ac.in/courses/102106087
- 2. https://ocw.mit.edu/courses/7-05-general-biochemistry-spring-2020/

CO-PO Mapping

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	3	2	1	-	-	-	-	-	1	1	-	-	2	-
CO2	3	2	1	-	-	-	-	-	1	1	-	-	2	-
CO3	3	2	1	-	-	-	-	-	1	1	-	-	2	-
CO4	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CO5	2	1	-	-	-	-	-	-	-	-	-	1	2	-
Avg.	2.6	1.6	1	-	-	-	-	-	1	1	-	1	2	-

5H-4C

Semester-III

Microbiology (Theory & Lab)

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

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

i) Theory

23BTBT342

Course Objectives

The goal of this course is for students to

- Illustrate the basic concepts of microbiology and different microbial identification techniques.
- Interpret the microbial growth and its metabolism. •
- Explain the microbial genetics in molecular level. •
- Discuss the various gene transfer takes place in microorganisms. •
- Infer the major groups of interactions and ecological diversity.
- Outline the mechanism for the control of microorganisms.

Course Outcomes

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

- 1. Outline the history of microbiology and microbial staining techniques.
- 2. Make use of the basic principles for the analysis of microorganism.
- 3. Explain the molecular genetics of microorganisms.
- 4. Outline major microbial interactional and their diversity.
- 5. Identify various the controlling mechanism of microorganisms.

UNIT I INTRODUCTION TO MICROBIOLOGY

History and Scope of Microbiology, Taxonomy and classification of microorganisms, Organization of Prokaryotic and Eukaryotic cell structure and Function, Bacteria-gram negative and gram positive, fungi- Ascomycetes and basidomyctes; Virus and classification of virus- bacteriophage.

UNIT II MICROBIAL NUTRITION AND GROWTH ASSESSMENTS 9h

Nutrients- micronutrients and macronutrients; Types of growth media, Different phases of growth curve, Culture methods, preservation methods; observations- Different staining techniques, Microscopy-compound microscope, phase contrast microscope, Fluorescence microscope and Electron Microscopes.

UNIT III MICROBIAL MOLECULAR BIOLOGY AND GENETICS

Genome and gene structure, Regulation of gene expression in prokaryotic cells (Operon System), Gene transfer- Transformation, Conjugation and Transduction; Applications-Microbial bioremediationby superbugs.

UNIT IV MICROBIAL ECOLOGY AND INTERACTION

Microbes from marine, freshwater and terrestrial environments, Various microbial interactions – Symbiotic, Non-symbiotic and pathogenic microbes, host-microbe interactions, Biogeochemical cycles- Carbon cycle, Nitrogen cycle, Sulphur cycle.

UNIT V CONTROL OF MICROOGANISMS

Physical and chemical control of microorganisms, Effect of heat, Sterilization, disinfectants, therapeutic agents, antimicrobial resistance, host-microbe interactions, antibacterial, anti-fungal, anti-viral agents, mode of action, resistance to antibiotics, clinically important microorganisms.

Total: 45 h

ii) Laboratory

List of experiments

- 1. Microbial Good Lab Practices and Biosafety
- 2. Media preparation and sterilization
- 3. Microscopic examination of different groups of microorganisms-bacteria and fungi
- 4. Simple streaking, T-streaking and quadrant streaking of bacteria.
- 5. Microbial simple and differential staining methods (Gram's staining)
- 6. Isolation and culture of culture using serial dilution from soil.
- 7. Microbial Growth Curve Determination
- 8. Effect of physical (Temperature) and chemical (pH) environment on growth
- 9. Biochemical tests for microbial identification-IMViC test
- 10. Antibiotic Sensitivity of Microorganisms

Total: 30h

Text Books:

- 1. Willey. J.M., Sherwood. L.M. and Woolverton C.J. (2011). Prescott's Microbiology, 8th Edition, McGraw-Hill International.
- 2. Pelczar. M. J. Chan. E.C.S. and Kreig N.R. (2015). Microbiology. 5th Edition. Tata McGraw-Hill Education.

9h

9h

References Books

- 1. Talaro. K.P. and Chess. B. (2017). Foundations in microbiology. 10th Edition. Tata McGraw-Hill Education.
- 2. Kolwzan. B., Adamiak. W., Grabas K. and Pawelczyk. A. (2006). Introduction to Environmental Microbiology, ebook

Web Links

- 1. https://microbiologyinfo.com/
- 2. https://microbenotes.com/

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	_	-	2	_
CO2	3	2	1	-	-	-	-	-	1	1	-	-	2	_
CO3	2	1	-	-	-	-	-	-	-	-	-	1	2	_
CO4	2	1	-	-	-	-	-	-	-	-	_	-	2	-
CO5	3	2	1	_	-	-	1	-	1	1	-	1	2	-
Avg.	2.4	1.2	1	-	-	-	1	-	1	1	-	1	2	-

CO / PO Manning

Semester-III

5H-4C

23BTBT343

Cell Biology

(Theory & Lab)

Instruction Hours/ week: L: 3 T: 0 P: 2 Marks: Internal: 40 External: 60 Total: 100

End Semester Exam: 3 Hours

i) Theory

Course Objectives

The goal of this course is for students

- Understand the properties of cell and cell structure •
- Elaborate the functions of muscle proteins and process of cell division •
- Outline the movement of molecules across the cell membrane.
- Discuss the role of receptors in cell signaling.
- Interpret the process of ATP synthesis in chloroplast and mitochondria
- Interpret the various cell metabolism and functions

Course Outcomes

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

- Identify the various structure of cell components 1.
- 2. Understand the functions of cytoskeletal proteins and cell cycle checkpoints.
- 3. Illustrate the transport process across the cell membrane.
- 4. Outline the basic ideas on signaling process through the receptors.
- 5. Experiment with eukaryotic cell for the isolation and characterization of mitochondria and chloroplast.

UNIT-I CELLULAR ARCHITECTURE

History, Basic properties of cell, comparison of eukaryotic and prokaryotic cells, membrane organization, theories, components; Structure of prokaryotic cells - cilia, flagella, cell wall; Structure and function of eukaryotic cell organelles: cytoplasm, endoplasmic reticulum, mitochondria, chloroplast, peroxisomes, nucleus.

UNIT-II CYTOSKELETAL PROTEINS & CELL DIVISION

Cell-cell interaction, Cytoskeletal proteins - Types, contractile proteins - actin & myosin, cell adhesion proteins; extracellular matrix; Types of cell division: mitosis & meiosis, Cell cycle, Checkpoints in cell cycle.

9h

9h

UNIT-III TRANSPORT ACROSS CELL MEMBRANES

UNIT-IV CELL SIGNALLING

Cytosolic, nuclear and membrane bound receptors, examples of receptors, Signal transduction by hormones, secondary messengers, autocrine, paracrine and endocrine modes of action, programmed cell death-apotosis.

pumps, lysosomal and vacuolar membrane ATP dependent proton pumps, co-transport, ABC transport,

UNIT- V FUNCTIONS OF MITOCHONDRIA AND CHLOROPLAST

symport, antiport; endocytosis and exocytosis; Entry of viruses and toxins into cells.

Chloroplast: photosynthetic stages and light-absorbing pigments, Mitochondria: Electron transport chain, Reduction Potentials of Electron Carriers, oxidative phosphorylation, ATP synthesis, cell lines. Total: 45 h

Laboratory ii)

List of experiment

- **1.** Laboratory Safety and Aseptic Techniques
- 2. Identification of given plant, animal and bacterial cells and their components by microscopy.
- 3. Staining Techniques: Giemsa Leishmann staining.
- 4. Staining for different stages of mitosis in Allium cepa (Onion).
- 5. Identification of different types of blood cells
- **6.** Isolation of chloroplasts from spinach leaves.
- 7. Quantitative analysis of lipid classes by TLC
- **8.** Cell fractionation
- **9.** Isolation of Mitochondria

Text Books

1. Lodish. H., Berk A., Zipurursky S.L., Matsudaria P., Baltimore D. and Darnell. J. (2000). Molecular Cell Biology. 4th Edition. Freeman press.

2. Alberts. B., Johnson. A., Lewis. J., Raff. M., Roberts K., and Walter. P. (2002). MolecularBiology of the Cell, Garland PUB.

3. Benjamin. A. pierce. (2016). Genetics a conceptual approach., Published by W. H. Freeman.

4. Venkata. R., Prakash.D. (2015). Key Notes on Genetics and Plant Breeding. Astral International publishers.

9h

9h

Total: 30 h

55

9h Diffusion, osmosis, Passive & active transport, Permeases, sodium potassium pump, Ca2⁺ ATPase

Reference Books

- 1. De Robertis. E.D.P. and De Robertis E.M.F. (2005). Cell and Molecular biology. B.I publications Pvt Ltd.
- 2. James. D. W., Baker .T., Bell Stephen.P., Gann Alexander., Levine Michael., and Losick Richard.(2004) Molecular Biology of the Gene.

Web Links

- https://microbiologyinfo.com/ 1.
- 2. https://microbenotes.com/

CO/PO	Mappi	ng												
COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	3	2	1	-	-	-	-	-	1	1	-	1	2	-
CO2	2	1	-	-	-	-	-	-	-	_	-	-	2	-
CO3	2	1	-	-	-	-	-	-	-	_	-	-	2	-
CO4	2	1	-	-	-	-	-	-	-	_	-	-	2	-
CO5	3	2	1	-	-	-	-	-	1	1	-	-	2	-
Avg.	2.4	1.4	1.0	-	-	-	-	-	1	1	-	1	2	-

SEMESTER-III

23BTMC351

APTITUDE & REASONING

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

COURSE OBJECTIVES:

The goal of this course is for the students to

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

COURSE OUTCOMES:

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

- 1. Explain the basics of quantitative ability.
- 2. Solve questions related to Logaraithm, Permutation and Combinations, Probability, Basic Accountancy, Time, Speed, distance, work, Ratio and area etc.
- 3. Utilize satisfactory competency in Verbal Reasoning Questions.
- 4. Solve campus placements aptitude papers covering Quantitative Ability and verbal skills.
- 5. Apply Quantitative and Verbal reasoning in puzzle-related questions.

UNIT - I 1. Quantitative Ability (Basic Mathematics)

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

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

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

2.9. Area

2.10 Mixtures and Allegation

IG1H - 0CMarks: Internal:100 Total:100End Semester Exam:3 Hours

UNIT – III 3. Verbal - Aptitude

- 1.1 Words
- 1.2 Idioms
- 1.3 Phrases in Context
- 1.4 Reading comprehension techniques
- 1.5 Narrative sequencing
- 1.6 Data interpretation

Textbooks:

- 1. A Modern Approach to Verbal & Non-Verbal Reasoning by R S Agarwal
- 2. Analytical and Logical Reasoning by Sijwali B S
- 3. Quantitative aptitude for Competitive examination By R S Agarwal
- 4. Analytical and Logical Reasoning for CAT and other management entrance tests By Sijwali B S
- 5. Quantitative Aptitude by Competitive Examinations by Abhijit Guha 4th edition

WEBSITES

- 1. https://prepinsta.com/
- 2. https://www.indiabix.com/
- 3. https://www.javatpoint.com/

CO / PO Ma	apping													
CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	3	-	-
Avg.	2.8	1.8	1	-	-	-	-	-	-	-	-	3	-	-

23BEMC351 A

SEMESTER-I FOREIGN LANGUAGE –GERMAN

1H-0C

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

Marks: Internal:100 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

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

COURSE OUTCOMES:

Upon completion of this course the students will be able to

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

UNIT-I:

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

UNIT-II :

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

UNIT-III :

Mein Lehrbuch | Meine persönlichen Daten-Mein Arbeitsbuch -Wir beginnen Lektion -Wir lesen Lektion

UNIT-IV:

formeller Brief- Wie lernst du Deutsch ? -Wir h \tilde{A} ¶ren ein deutsches Lied- Wir lernen H \tilde{A} ¶rverst \tilde{A} ¤ndnis | Wir beginnen Lektion

UNIT V

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

BOOKS AND REFERENCES:

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

WEB RESOURCES:

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

23BEMC351 B

SEMESTER-I FOREIGN LANGUAGE –FRENCH

1H-0C

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

Marks: Internal:100 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

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

COURSE OUTCOMES:

Upon completion of this course the students will be able to

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

UNIT- I

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

UNIT - II

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

UNIT – III

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

UNIT – IV

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

BOOKS AND REFERENCES:

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

WEB RESOURCES:

- <u>www.leo.org</u>
- WWW. Nptel.com

23BTBT344	Internship/ Field Project	1H-0C

Instruction Hours/ week: L: 0 T: 0 P: 1 Marks: Internal: 100 External: 0 Total: 100 End Semester Exam: 3 Hours

Minimum of three weeks in an Industry preferably in the area of Biotechnology. The summer internship should give exposure to the practical aspects of the discipline. In addition, thestudent may also work on a specified task or project which may be assigned to him/her. The outcome of the internship should be presented in the form of a report. This course is aimed to provide more weightage for project work. The project work could be done in the form of a summer project or internship or field project in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.

Note: AICTE Internship Policy available on AICTE's website may be referred for moreinformation regarding Internship.

Guidance/Remarks:

Internship needs to be done in Summer Break after Semester - II and will be considered for evaluation in Semester - III.

SEMESTER IV

23BTBT401

BIOSTATISTICS

SEMESTER-IV 4H-4C

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

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

COURSE OBJECTIVES:

The goal of this course is for students to:

- Gain knowledge in various methods of data collection.
- Provide the required fundamental concepts of probability theory and Random variables.
- Impart the knowledge of Measures of Central tendencies, Dispersions
- Inculcate the knowledge of testing of hypothesis using small and large sampling tests.
- Introduce the basic concepts of classifications of design of experiments.

COURSE OUTCOMES:

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

- 1. Illustrate the data set graphically to display the given information
- 2. Explain the fundamentals of probability and standard distributions
- 3. Make use of statistical data for finding the measures of central tendency and measures of dispersion.
- 4. Apply small and large samples tests in Biometric experiments
- 5. Utilize analysis of variance in completely randomized design, Randomized block design and Latin square design

UNIT I DATA COLLECTION

Definition, scope, functions and limitations of Statistics – Collection, Classification, Tabulation of data, Diagrammatic representation of data – Simple, Multiple and Percentage Bar diagram, Pie diagram and Graphical representation of data – Histogram, frequency polygon, frequency curve and ogives. Primary and Secondary data – Questionnaire method.

UNIT II PROBABILITY AND RANDOM VARIABLES

Concept of Probability – Conditional probability – Total Probability – Baye's theorem and its applications – One dimensional Random Variables (Discrete and Continuous) – Mathematical Expectation -Distributions – Binomial, Poisson and Normal.- Applications of Binomial and Normal distributions - Applications to Biological Studies.

UNIT III DESCRIPTIVE STATISTICS

Measures of central tendency —Measures of Dispersions — Measures of Skewness – Pearson's, Bowley's method. Measure of Bivariate data – Simple, Partial and Multiple Correlation. Scatter diagram, Pearsons method and Rank correlation method. Regression and their equations.

12

63

12

UNIT IV SAMPLING THEORY

Test of hypothesis – Large sample tests based on normal distribution – Test for single mean – Difference between means – Proportion – Difference between proportion – Small sample test – Student-t test – Test for single mean – Difference between means – Snedecor's F test – Chi-square test for goodness of fit, independence of attributes. test for correlation and regression coefficients. Applications to Biometric experiments.

UNIT V DESIGN OF EXPERIMENTS

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

TOTAL HOURS: 60

TEXT BOOKS:

- 1. Gupta, S.P. (2011) Statistical Methods, Sultan Chand & Sons, Pvt. Ltd, New Delhi.
- 2. Gupta, S.C and V.K. Kapoor, (2011) Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Pvt. Ltd, New Delhi
- 3. Darren George, Paul Mallery (2011) SPSS for Windows, 10th Edition, PEARSON.
- 4. Geoffrey Grimmett and David Stirzaker, Probability and Random Processes, Oxford University Press, Fourth Edition, 2020.
- 5. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, Introduction to Mathematical Statistics, Pearson, Eighth Edition, 2019.

REFERENCE BOOKS:

- 1. Irwin Miller and Marylees Miller, John E Freund's Mathematical Statistics with Applications Pearson, Eighth Edition, 2014
- 2. Sheldon M Ross, Introduction to Probability and statistics for Engineers and scientists Elsevier, Fourth Edition, 2014
- 3. <u>Douglas C. Montgomery</u>& <u>George C. Runge</u>r, Applied Statistics and Probability for Engineers John Wiley, Sixth Edition, 2016.

WEB URLs:

- 1. <u>https://onlinecourses.nptel.ac.in/noc23_ge25/preview</u>
- 2. <u>https://nptel.ac.in/courses/111106112</u>
- 3. https://nptel.ac.in/courses/111104032
- 4. https://nptel.ac.in/courses/111105042
- 5. https://nptel.ac.in/courses/103106120

CO PO MAPPING:

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

		Semester-IV
23BTBT402	Chemical Thermodynamics	4H-4C

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

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

Course Objectives

The goal of this course is for students

- Explain the thermodynamic properties of fluids and its calculations.
- Discuss the basic concepts of solution properties.
- Illustrate the phase equilibria concepts for various systems.
- Outline the equilibrium criteria for various chemical reactions. •
- Infer the knowledge on general thermodynamic processes.
- Understand the industrial concepts in thermodynamics.

Course Outcomes

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

- 1. Summarize various properties of the fluids and its calculations.
- 2. Explain the concept of solution thermodynamics and composition models.
- 3. Outline the criteria of phase equilibria for different component system.
- 4. Explain chemical reaction equilibria and equilibrium conversion.
- 5. Illustrate chemical reaction equilibrium.

UNIT-I BASIC CONCEPTS IN CHEMICAL THERMODYNAMICS

First and second law of thermodynamics, calculation of work, energy and property changes in reversible processes, thermodynamics of flow processes, power cycles (rankine, regenerative, reheat); liquefaction and refrigeration cycle.

UNIT-II THERMODYNAMIC PROPERTIES OF FLUIDS

Volumetric properties of fluids exhibiting non ideal behavior; residual properties; estimation of thermodynamic properties using equations of state; Actual property exchanges - Calculations; Maxwell's relations and applications.

UNIT- III SOLUTION THERMODYNAMICS

Partial molar properties; concepts of chemical potential and fugacity; ideal and non-ideal solutions; concepts and applications of excess properties of mixtures; activity coefficient; composition models; Gibbs Duhem equation.

10h

10h

UNIT- IV PHASE EQUILIBRIA

Criteria - phase equilibria; V-L-E calculations for binary and multi component systems; liquid- liquid equilibria and solid-solid equilibria.

UNIT- V CHEMICAL REACTION EQUILIBRIA

Equilibrium criteria - homogeneous chemical reactions; evaluation of equilibrium constant; effect of temperature and pressure on equilibrium constant; calculation of equilibrium conversion and yields for single and multiple reactions.

Text Books

1. Smith. J.M., Van Ness H.C. and Abbot. M.M. (2001). Chemical EngineeringThermodynamics. McGraw-Hill.

2. Narayanan. K.V. (2001). A Text Book of Chemical Engineering Thermodynamics. PrenticeHall India.

Reference Books

- 1. Sandler. S.I. (1989). Chemical and Engineering Thermodynamics. John Wiley.
- 2. Stockar. U.V., Luuk A.M. and Wielen V.D. (2013). Biothermodynamics: The Role of Thermodynamics in Biochemical Engineering. EPFL Press.

Web Links

1. https://chem.libretexts.org/Bookshelves/General_Chemistry/

CO/PO	Марріі	ng												
CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	2	-
Avg.	2	1	-	-	-	-	-	-	-	-	-	-	2	-

10h

10h

Total: 50h

		Semester-IV
23BTBT403	Basics of Industrial Biotechnology	3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Explain the basic idea on scope of biotechnology and its commercial production in modern biotechnology.
- Outline about basic biotechnological techniques used for commercial production of bioactive compounds.
- Discuss the process of primary metabolite production in different industries.
- Discuss the process of secondary metabolite production.
- Explain the basic procedures for production of bio-products.
- Illustrate the various methods for the production of recombinant products.

Course Outcomes

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

- 1. Outline the scope of biotechnology and its commercial potential.
- 2. Interpret the modern biotechnological processing techniques for the production of commercial bio-products.
- 3. Illustrate the production methods of primary metabolites.
- 4. Summarize the production methods of secondary metabolites.
- 5. Apply the knowledge on commercial enzyme and bio-product production.

UNIT I- INTRODUCTION TO INDUSTRIAL BIOPROCESS

Biotechnology: Scope and importance, Commercial potential of Biotechnology in India. Traditional and modern biotechnology. Products relating to modern biotechnology, industrially important organisms, fermentation processes – modes of operation.

68

B.Tech. Biotechnology

UNIT II - PRODUCTION OF PRIMARY METABOLITES

Production of commercially important organic acids - citric acid, lactic acid, acetic acid, gluconic acid; amino acids - glutamic acid, phenyalanine, aspartic acid; alcohols - ethanol, butanol.

UNIT III- PRODUCTION OF SECONDARY METABOLITES

Secondary metabolites: antibiotics: beta-lactams (penicillin, cephalosporin), aminoglycosides (streptomycin) macrolides (erythromycin), vitamins (B12) and steroids (progesterone).

UNIT IV- PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS 9h

Production of industrial enzymes - proteases, amylases, lipases, cellulases etc., Production of biopesticides, biofertilizers, biopreservatives (Nisin), cheese, biopolymers (xanthan gum, PHB), single cell protein.

UNIT V-PRODUCTION OF RECOMBINANT DNA PRODUCTS

Production of recombinant proteins - therapeutic and diagnostic applications, production of vaccines (hepatitis B vaccine), hormones (insulin). Production of monoclonal antibodiescommercial scale, products of plant (human growth hormone) and animal cell culture (interferons).

Total :45 h

Text Books:

- 1. Casida Jr. L.E. (2006). Industrial Microbiology. 2nd Edition. New Age International, India.
- 2. Reed G. (2004). Prescott & Dunn's Industrial Microbiology. 4th Edition. CBS Publishers & Distributors.
- 3. Cruger. W. (2017). Crueger's Biotechnology: A Textbook of Industrial Microbiology. 3rd Edition. Medtech, India.

Reference books

1. Dubey, R.C. (2014). Text book of Biotechnology. 5th Edition. S Chand Publishers, India.

Web Links

1: https://archive.nptel.ac.in/courses/102/105/102105058/

9h

9h

CO / PO Mapping														
COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	2
CO2	2	1	-	-	1	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	2
Avg.	2.2	1.2	1	-	1	-	-	-	-	-	-	1	-	2

TT7

			Semester-1v			
23BTBT441	Analytica	al Techniques	5H-4 C			
	(Theory & Lab)					
Instruction Hours/ week: L: 3	T: 0 P: 2	Marks: Internal: 40 H	External: 60 Total: 100			
		End Sei	mester Exam: 3 Hours			

i) Theory Course

Objectives

The goal of this course is for students to

- Paraphrase the basic concepts of wave properties and radiation sources
- Outline the different separation techniques for product purification
- Describe the concepts and instrumentation of modern microscopic techniques.
- Discuss various strategies utilized for the analysis of spectroscopy and NMR.
- Explain the theory and instrumentation of analytical spectroscopy.
- Illustrate the real time analytical techniques for genome sequencing.

Course Outcomes

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

- 1. Summarize the basic concepts of wave properties and radiation sources
- 2. Identify the separation techniques for product purification.
- 3. Illustrate the basic working of modern microscopic techniques.
- 4. Experiment with spectroscopy and NMR techniques.
- 5. Infer the working mechanism of real time analytical techniques.

UNIT-I FUNDAMENTALS OF ANALYTICAL TECHNIQUES

Tools of analytical methods: Experimental error, chemical equilibrium, Quality assurance - Optical instrument – components of optical instruments– Sources of radiation – wavelength selectors – sample containers – radiation transducers – Signal process and read outs – signal to noise ratio - sources of noise – Enhancement of signal to noise - types of optical instruments – chemical analysis, tools for quantitative chemical analysis, acid base titration.

UNIT-II SEPARATION TECHNIQUES

General description and classification of Chromatography - Theory, instrumentation and Applications of the following chromatographic techniques: Ion-Exchange, Affinity, Hydrophobic, Size exclusion, FPLC, HPLC, UPLC; Ultracentrifugation, Electrophoresis.

9h

71

B.Tech. Biotechnology

UNIT-III MICROSCOPY TECHNIQUES

Introduction to optics, principles of image formation, principles of fluorescence, digital imaging, Light spectroscopy and Microscopy-Absorption, IR, Scattering, Resonance Raman, Fluorescence (steady-state and time resolved), confocal microscopy, Multi-photon microscopy, Atomic Force Microscopy, Scanning electron microscope and Transmission electron microscope.

UNIT-IV SPECTROSCOPY AND NMR

Theory of UV-Visible Spectroscopy & Calorimetry, Beer Lambert law, Deviation from Beer Lambert law. Mass spectroscopy- Basic principles & brief outline of instrumentation, LC- MS, GC-MS, MS-MS, MALDI-Mass imaging; NMR spectroscopy: Introduction, Theory & Instrumentation, chemical shift concept, spinspin coupling, isotopic nuclei, reference standards & solvents, applications., X-ray crystallography.

UNIT- V REAL TIME ANALYTICAL TECHNIQUES

Introduction of real time analytical techniques - Proteomics, MS and NMR based Metabolomics, DNA and RNA sequencing for genomics, PCR for transcriptomic, Real time PCR, qRT-PCR, Droplet PCR, Surface Plasmon Resonance (SPR), Highcontent screening. Analysis of cell culture, cell solving FASC

(ii) Laboratory

List of experiment

- 1. Determination of maximum wavelength of KMNO₄ using spectrophotometer.
- 2. Absorption spectrum of plant pigments.
- 3. Finding the molar absorbtivity and stoichiometry using absorption spectrometry.
- 4. Finding the pK_a of 4-nitrophenol using absorption spectroscopy.
- 5. Separation and identification of amino acid using paper chromatography
- 6. Separation and identification of amino acid using TLC
- 7. Protein purification using gel filtration chromatography.
- 8. UV spectra of nucleic acids

Text Books

- 1. Charles R. Canter and Paul R. Shimmel, 1980, Biophysical Chemistry, Vol II, W. H. Freeman.
- 2. Robert K. Scopes (Narosa), 1994, Protein Purification: Principles and Practice, Springer-Verlag New York.
- 3. Joseph R. Lakowicz , 2006, Principles of Fluorescence Spectroscopy, Springer US.

9h

9h

9h

Total: 45 h

Total: 30 h

Reference Books

- 1. Barbar Stuart, 2004, Infrared Spectroscopy Fundamentals and Applications, Wiley online library.
- 2. Richard L. McCreery, 2000, Raman Spectroscopy for Chemical Analysis, Wiley online library.
- 3. Harald Gunther, 2013, NMR spectroscopy, 3rd Edition, Wiley.

Weblink

1. www.labcompare.com/Laboratory-Analytical-Instruments/

CO / PO Mapping														
CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	2
CO4	3	2	1	-	-	-	-	-	1	1	-	-	-	2
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	2
Avg.	2.4	1.4	1	-	-	-	-	-	1	1	-	1	-	2

2023-2024

23BTBT442

Genetic Engineering

Semester-IV 5H-4C

(Theory & Lab)

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

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

i) Theory Course

Objectives

The goal of this course is for students to

- Understand the basic concepts in rDNA technology.
- Explain the importance of recombinant molecules in rDNA technology.
- Understand the gene libraries construction and to perform blottings.
- Outline the concepts involved in gene library construction and differentiate betweendifferent gene libraries.
- Explain about the different types of PCR, the main concept in genetic engineering.
- Understand the vast applications of rDNA technology in diverse fields.

Course Outcomes

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

- 1. Discuss the knowledge on the basics of rDNA technology.
- 2. Construct recombinant molecules in research and development.
- 3. Make use of the knowledge required to gene libraries construction and to perform blottings.
- 4. Summarize the principles of PCR reactions.
- 5. Infer the importance of DNA sequencing methods.

UNIT I - BASICS OF RECOMBINANT DNA TECHNOLOGY

Genetic elements that control gene expression in prokaryotes and eukaryotes. Repressors and promoters- methods of creating DNA molecules, Isolation and separation of genomic and plasmid DNA; restriction and modifying enzymes, safety guidelines of recombinant DNA research.

UNIT II - CREATION OF RECOMBINANT MOLECULES 9h

Restriction mapping, design of linkers and adaptors, gene editing.Characteristics of plasmid and phage vectors, prokaryotic and eukaryotic expression vectors.Insect, Yeast and Mammalian vectors.

B.Tech. Biotechnology

UNIT III - CONSTRUCTION OF LIBRARIES

Construction of cDNA and genomic libraries.Screening of libraries with DNA probes and with antisera.Cloning : Characterization of recombinant clones by southern, Northern, western and PCR analysis, factors affecting foreign gene expression,over expression and purification of recombinant proteins.

UNIT IV –POLYMERASE CHAIN REACTION AND SEQUENCING

DNA amplification, primer synthesis – Taq polymerase – Types of PCR -Inverse PCR, Nested PCR, RACE PCR, RAPD, Taqman assay, Molecular beacons, site directed mutagenesis (Kunkels Method) - methods of nucleic acid sequencing- Sangers method.

UNIT V – APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY 9h

Applications of recombinant DNA Technology in agriculture, pharmaceutical industry and medicine- knockout animals, Production of novel products, Antisense technology - transgenic animals - embryo transfer eg.Dolly : Cloning in plants, Ti plasmid, Methods of producing transgenic animals and their applications, gene silencing, gene therapy.

Total: 45 h

ii) Laboratory

List of experiment

- 1. Isolation of plasmid DNA and genomic DNA from bacterial cell
- 2. Isolation of RNA
- 3. Isolation of plant cell genomic DNA from plant source
- 4. Purification of DNA from agarose gel
- 5. Restriction enzyme digestion and ligation
- 6. Competent cells preparation (CaCl₂ method)
- 7. Transformation and screening for recombinants- Blue white screening assay
- 8. Protein isolation using SDS PAGE
- 9. Western blotting

Total: 30h

Text Books

1. Primrose. S.B. and Twyman. R.M. (2006). Principles of GeneManipulation and Genomics.7th Edition. Blackwell Publishers.

2. Ansubel. F.M., Brent. R., Kingston. R.E. and Moore D.D. (2003).Current Protocols in Molecular Biology. Greene Publishing Associates.

Reference Books

1. Chaitanya. K.V. (2013). Cell and Molecular Biology, A Lab Manual.Prentice Hall India, Learning Private Limited.

2. Vennison. S.J. (2009). Laboratory Manual for Genetic Engineering.Prentice Hall India,

9h

9h

B.Tech. Biotechnology

Learning Private Limited.

Weblinks

1. https://www.genome.gov/genetics-glossary/Genetic-Engineering

CO / PO Mapping

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	2	1
CO2	3	2	1	-	-	-	-	-	1	1	-	-	2	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	1	-	-	-	-	-	1	1	-	1	2	1
CO5	2	1	-	-	-	-	-	-	-	-	-	-	2	-
Avg.	2.4	1.4	1	-	-	-	-	-	1	1	-	1	2	1

23BTMC551	2023 - 2024
SEMESTER - V	
Foundation of Entrepreneurship	1H - 0C
Instruction Hours/week: L:1 T:0 P:0	Marks: Internal:100 Total:100

COURSE OBJECTIVES:

The goal of this course is for the students to

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

COURSE OUTCOMES:

Upon completion of this course the students will be able to

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

Unit I Entrepreneural Competence

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

Unit II Entrepreneural Environment

Business Environment - Role of Family and Society - Entrepreneurship Development

Unit III Business Plan Preparation

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

Text Books

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

23BTMC451

2023 - 2024

End Semester Exam: 3 Hours

SEMESTER - IV Essence of Traditional Indian Knowledge and Heritage 1H - 0C

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

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

COURSE OBJECTIVES:

The goal of this course is for the students to

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

COURSE OUTCOMES:

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

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

UNIT I Introduction to Indian Thought and Culture

Plurality of Indian Culture - Cultural Diversity and Cultural Unity -Different Manifestations of Indian Culture: Indus Valley culture -Vedic Culture and Dravidian culture.-The Medieval Bhakti Culture

UNIT II Traditional Knowledge Systems of India

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

UNUI III Protection of Traditional Knowledge

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, the value of TK in the global economy, Role of Government to harness TK.

Textbooks:

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

		Semester-V
23BTBT541	Bioprocess Engineering	5H-4C
	(Theory & Lab)	
Instruction Hours/ week: L: 3 T	: 1 P: 2 Marks: In	ternal: 40 External: 60 Total: 100
		End Semester Exam: 3 Hours
i) Theory		
Course Objectives		

The goal of this course is for students to

- Outline the fundamentals of bioprocess engineering.
- Design the kinetic parameters of microbial growth.
- Illustrate the process design and control of bioreactors.
- Design the rheological parameters and scale up of fermentation process.
- Analyze the simulation and validation program for bioprocess technology.
- Design the bioreactor for biological applications

Course Outcomes

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

- 1. Summarize the general requirements and various types of fermentation process.
- 2. Experiment with the growth kinetics of microorganisms.
- 3. Compare the various designs of bioreactor and its control mechanisms.
- 4. Solve the problems associated with scale up parameters for mixing requirements.
- 5. Make use of the simulation software for the design of bioreactors.

UNIT - I - INTRODUCTION OF BIOPROCESS ENGINEERING 10h

Historical development of Bioprocess technology, General requirements and types of fermentation processes - aerobic and anaerobic fermentation process, solid-state and submerged fermentation. Modes of bioprocess - batch, fed-batch and continuous bioreactors, Immobilized cell systems.

UNIT - II - GROWTH KINETICS

Batch growth, balanced growth, effect of substrate concentration - Monod model - determining cell kinetic parameters from batch data - structured and unstructured models - microbial growth kinetics, substrate utilization, and product formation kinetics - stoichiometry

- energy balance - principles of enzyme catalysis - enzyme kinetics - immobilized enzymes.

UNIT - III - PROCESS DESIGN AND CONTROL OF BIOREACTORS 10h

Bioreactor design and construction - Reactor Engineering in perspective. Types of Reactors(Batch, Fed, Batch and Continuous) Design of Stirrers and impellers. Principles and Strategies forControl of Bioreactors (feedback, feed forward, adaptive and statistical control, fuzzy logic control).

UNIT - IV - RHEOLOGY AND SCALE UP OF FERMENTATION 10h

Newtonian and Non Newtonian fluids, Effect of scale on oxygenation, mixing, sterilization, nutrient availability and supply. Calculation of mass transfer coefficient in fermentation, Bioreactor scale up based on constant power consumption per volume, mixing time, impeller tip speed (shear) and mass transfer coefficient.

UNIT - V - SIMULATION AND VALIDATION IN BIOPROCESS TECHNOLOGY 10h

Introduction to Process Analytical Technology (PAT) and Quality by Design (QbD). Simulation techniques (Software): steady state material and energy balance programs (Pacer, Flowtran, Chess); Simulation of batch reactor using Matlab, Simulink for dynamic systems. Application of modelling and simulation in bioprocess industries

Total :50 h

ii) Laboratory:

List of experiments

- 1. Microbial growth kinetics and estimation of cell mass
- 2. Growth inhibition kinetics
- 3. Operation of pH control and dissolved oxygen measurement
- 4. Enzyme immobilization techniques
- 5. Bioconversion using immobilized enzyme preparation
- 6. Product formation kinetics in a fermentation process
- 7. Effect of mixing and agitation in bioreactors
- 8. Estimation of volumetric oxygen transfer coefficient

Total: 30 h

Text Books

- 1. Shuler and Kargi. (2017). Bioprocess Engineering Basic concepts. 2nd Edition. Pearson.
- 2. Stanbury P.F., Hall. S.J. and Whitaker. A. (2017). Principles of Fermentation technology.3rd Edition. Elsevier.

Reference Books

1. Bailey J.E. and Ollis D.F. (2015). Biochemical Engineering Fundamentals. 2nd Edition. Tata McGraw-Hill.

B.Tech. Biotechnology

- 2. Pauline M. Doran. (2013). Bioprocess Engineering principles. 2nd Edition. Elsevier.
- 3. Blanch H.W. and Clark D.S. (2012). Biochemical Engineering. 2nd Edition. Marcel Dekker.

Weblink

1. https://byjus.com/neet/types-of-fermentation/

CO/POM	apping													
CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	2	1	-	-	-	-	-	1	1	-	-	-	2
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	2
Avg.	2.4	1.4	1	-	-	-	-	-	1	1	-	-	-	2

Somester V

		Semester - v
23BTBT542	Immunology and Immunotechnology	5H-4 C
	(Theory & Lab)	
Instruction Hours/ week: L: 3	T: 0 P: 2 Marks: Internal: 40 Ex	ternal: 60 Total: 100
	End Seme	ester Exam: 3 Hours

i) Theory

Course objectives:

The goal of this course is for students to

- Understand the basic knowledge of cells and organs of Immune system.
- Explain the different cellular responses and its functions.
- Outline the Immune responses to various disease and different immunologic reactions in Human body.
- Explain the organ transplantation and tumor immunology.
- Outline the basics of autoimmunity.

Course outcomes:

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

- 1. Identify various cells and components of immune system.
- 2. Explain the basics of B, T cells, genes and generation of antibody and its functions.
- 3. Make use of basics to study monoclonal antibodies and antigen- antibody interactions.
- 4. Apply the concept of immunity and various immunological responses to infections.
- 5. Illustrate the basics of Transplantation and tumor therapies.

UNIT-I INTRODUCTION

Organization and classification of immune system: Cells of immune system & primary and secondary lymphoid organs, types of immune responses: innate and acquired immunity, Components of immune system: Types of antibodies, classification of antigens- chemical and molecular nature; haptens, adjuvants; cytokines, Allergens

UNIT-II CELLULAR RESPONSES

Development, maturation, activation and differentiation of T-cells and B-cells: TCR, antibodies, structure and functions; antibodies: genes and generation of diversity; antigen-antibody reactions; monoclonal antibodies: principles and applications; antigen presenting cells; major histocompatibility complex; antigen processing and presentation; regulation of T-cell and B-cell responses.

UNIT-III INFECTION AND IMMUNITY

Injury and inflammation; immune responses to infections, Complementary system,

9h

9h

B.Tech. Biotechnology

Transplantation: laws of transplantation, Graft rejection – Mechanisms; Allergy and hypersensitivity – Types of hypersensitivity, Auto immune disorders and diagnosis

UNIT - IV IMMUNO PATHOLOGY

Preparation of storage of tissues- tissue processing, histology-preparation, straining method, immunohistology; identification of various cell types and antigens in tissues, fluroscenes activated cell sorting(FACS); cell isolation and characterization of cell types from inflammatory sites and infected tissues, immune cytochemistry – immuno fluoresecence.

UNIT-V IMMUNOTECHNIQUE

Isolation of immune cells from Human and animals; Antigen & antibody interaction based techniques - precipitation reaction, agglutination reaction, Radio-immunoassay, ELISA, Western Blot, Immunoprecipitation, flow cytometry, immune electron microscopy; Classification of Vaccines, methods of vaccine development, immune modulatory drugs.

Total: 45h

ii) Laboratory

List of experiments

- 1. Handling of animals, immunization and raising antisera
- 2. Identification of cells in a blood smear
- 3. Identification of blood group
- 4. Immuno diffusion
- 5. Immuno electrophoresis
- 6. Testing for typhoid antigens by Widal test
- 7. Enzyme Linked Immuno Sorbent Assay (ELISA)
- 8. Isolation of peripheral blood mononuclear cells
- 9. Identification of T cells by T-cell rossetting using sheep RBC.
- 10. Western blotting

Text Books

- 1. Roitt I. Male and Brostoff. (2012). Immunology. 8th Edition. Mosby publications.
- 2. Judy Owen, Jenni Punt and Sharon Stranford. (2013). Kuby Immunology. 7th Edition.

Reference Books

- 1. David W. Mount. (2004). Bioinformatics: Sequence and Genome Analysis. 2nd Edition. Cold Spring Harbor Laboratory Press, U.S.
- 2. Chakravarty. A.K.. (2006). Immunology and Immunotechnology. 1st Edition. Oxford University Press.

Weblinks

1. https://www.immunology.org/public-information/what-immunology

9h

9h

Total: 30h

CO / PO Ma	apping													
CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO3	3	2	1	-	-	-	-	-	1	1	-	-	-	2
CO4	3	2	1	-	-	-	-	-	1	1	-	-	-	2
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	2
Avg.	2.6	1.6	1	-	-	-	-	-	1	1	-	1	-	2

Semester-V

			bennester v
23BTBT543	Bioinfo	rmatics	5H-4C
	(Theo	ory & Lab)	
Instruction Hours/ week: L:	3 T: 0 P: 2	Marks: Internal:	40 External: 60 Total: 100
		Enc	I Semester Exam: 3 Hours

i) Theory

Course Objectives:

The goal of this course is for students to

- Summarize the various algorithmic concepts involved in solving biological problems.
- Outline analyse and interpret biological sequence data using computational approaches.
- Construct phylogentic tree using multiple sequence alignment
- Provide an appropriate information on selection of tools for protein analysis.
- Apply, interpret and analyze protein structures prediction algorithms.
- Understand the fundamentals of machine learning techniques.

Course Outcomes (COs):

After successful completion of the course, the students should be able to

- 1. Infer the knowledge of mathematics and science in biological sequence analysis
- 2. Apply the basics of computers in biological sequence data analysis.
- 3. Make use of software for protein analysis.
- 4. Identify various interactions among protein molecules using various software tools
- 5. Explain the modeling of bio-based system using artificial neural networks

UNIT - I BASICS OF BIOINFORMATICS & BIOLOGICAL DATABASES 9h

Introduction to Bioinformatics; Computers in Biology to understand Biological System; Introduction to Biological Databases Protein Sequence and Structural Databases; Nucleic acid databases; Genome databases; Specialized Databases; Carbohydrate Databases; Clinically relevant drug interactions databases; Information retrieval from Biological databases: Entrez system, TCGA data bases, Bioportal.

UNIT II : SEQUENCE ALIGNMENT

Multiple sequence alignment (MSA, Assessing the quality of an alignment, Profiles; Hidden Markov models, Phylogeny - Clustering method, Cladistics methods; the problem of varying rates of evolution, Bootstrapping. Case study: Phylogenetic Analysis with a new distance measure

UNIT III : PROTEIN STRUCTURE ANALYSIS

Protein stability and folding, Superposition of structures and structural alignments-DALI and MUSTANG, Evolution of protein structure - classification, databases; Protein structure prediction and modeling - Aprori and Empirical methods; Secondary structure prediction, Homology

9h

modeling, foldrecognition, Protein structure comparison

UNIT IV MEDICAL AND PHARMACY INFORMATICS

Introduction to pharmacy informatics, Medical Transcription, Role of informatics to enhance the services provided by pharmaceutical care givers. Health Information Systems Architecture, Health Data Management, Medical Coding, Telemedicine and Telehealth, Ethics in medical informatics, Pharmacy systems and automation, Informatics applications in pharmacy, survey and evaluation of on-line resources.

UNIT V : APPLICATIONS IN BIOINFORMATICS

Artificial Neural Network – Perceptron, Characteristics of neural networks, models of neuron, Single and multi-layer, Application of ANN., Introduction to Drug Discovery Process, Target Identification and Validation, Virtual Screening of lead compounds, Docking (Principles, Rigid and Flexible docking).

Total: 45h

ii) Laboratory:

List of experiments:

- 1. Biological Databases- Sequence Databases, Structure Databases, Specialized Databases; Data Retrieval tools and methods; Database file formats.
- 2. Pairwise alignment of sequence
- 3. Multiple sequence alignment- Dotplot analysis Clustal OMEGA, ClustalX, ClustalW, T-Coffee.
- 4. Molecular visualization using Pymol and Chimera
- 5. Primer design using BLAST
- 6. Construction of phylogenetic tree Maximum Parsimony & Maximum Likelihood method NJ,UPGMA method PHYLIP program
- 7. Protein sequence analysis -ExPASy proteomics tools.
- 8. Autodock

Total: 30h

Textbook:

1. Bioinformatics: Methods and Applications. United Kingdom, Elsevier Science, 2021. 2 Hasija, Yasha. All About Bioinformatics: From Beginner to Expert. Netherlands, Elsevier Science, 2023.

References Books

 Rastogi, Parag, et al. Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery. India, Prentice Hall India Pvt., Limited.
 Mallick, Bibekanand, and Ghosh, Zhumur. Bioinformatics: Principles and Applications. India, Oxford University Press, 2008.

9h

WEBSITES

- 1: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1122955/
- 2: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6893424/
- 3: https://www.nature.com/articles/s41598-020-57916-9

CO/P	О Марр	ing												
CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	2	1	-	1	-	-	-	1	1	-	1	1	2
CO3	3	2	1	-	1	-	-	-	1	1	-	-	1	2
CO4	3	2	1	-	1	-	-	-	1	1	-	-	-	2
CO5	2	1	-	-	1	-	-	-	-	-	-	-	-	2
Avg.	2.6	1.6	1	-	1	-	-	-	1	1	-	1	1	2

SEMESTER-V

1H-0C

23BTBT551 CYBER SEC

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

COURSE OBJECTIVES:

The goal of this course is for students to

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

COURSE OUTCOMES:

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

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

UNIT I NETWORKING BASICS

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

UNIT II BASICS OF DIGITAL SECURITY

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

UNIT III INTRODUCTION TO CYBER-ATTACKS

Introduction to cyber-attacks, application security (design, development and testing), operations security, monitoring, identifying threats and remediating them, Principles of data security - Confidentiality, Integrity and Availability, Data Privacy, Data breaches, preventing attacks and breaches with security controls, Compliance standards, Computer Ethics.

UNIT IV TOOLS AND METHODS

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

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore - 641 021

CYBER SECURITY

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

9h

9h

9h g pr

UNIT V CYBER SECURITY ORGANIZATIONAL IMPLICATIONS 9h

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

TEXT BOOKS:

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

REFERENCES BOOKS:

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

CO/P	O Mapp	ing												
CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	2	-	-	-	-	-	-	-	-
CO2	3	2	2	2	-	2	-	-	-	-	-	-	-	-
CO3	3	3	2	2	-	2	-	-	-	-	-	-	-	-
CO4	3	3	2	2	-	2	-	-	-	-	-	-	-	-
CO5	3	2	2	2	-	2	-	-	-	-	-	-	-	-
Avg.	3	2.6	2	2	-	2	-	-	-	-	-	-	-	-

CO-PO MAPPING

B.Tech. Biotechnology			2023-2024
B.Tech Biotechno	logy		2023-2024
			Semester-V
23BTBT591	Internshi	p/Field Project	4H-2C
Instruction Hours/we		Marks. Internal.	100 External: 0 Total: 100

Minimum of three weeks in an Industry preferably in the area of Biotechnology. The summer internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship should be presented in the form of a report. This course is aimed to provide more weightage for project work. The project work could be done in the form of a summer project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.

Note: AICTE Internship Policy available on AICTE's website may be referred for more information regarding Internship.

Guidance/Remarks:

Internship needs to be done in Summer Break after Semester - IV and will be considered for evaluation in Semester - V.

End Semester Exam: 3 Hours

Semester-VI

SEMESTER VI

23BTBT601	Heat and Mass Transfer	4H-4C

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

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

Course Objectives

The goal of this course is for students to

- Explain the basic concepts of heat transfer operations.
- Infer the significance of heat exchangers and heat transfer with phase change.
- Evaluate the diffusion and liquid vapour mass transfer.
- Explain the mass transfer in liquid-gas and liquid-liquid.
- Interpret the applications of heat and mass transfer in biological systems.
- Outline the equilibrium criteria for various chemical reactions.

Course Outcomes

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

- 1. Infer the basic concepts of heat transfer operations and different modes of heat transfer.
- 2. Construct the heat exchangers to study the transfer of heat with phase change.
- 3. Make use of the theories of diffusion and the principle of distillation processes.
- 4. Solve problems associated with gas liquid and liquid- liquid mass transfer operations.
- 5. Apply the principles of heat and mass transfer in bioreactor system.

UNIT - I BASICS OF HEAT TRANSFER OPERATIONS

10 h

Modes of heat transfer operation: Fourier's law of heat conduction, heat transfer resistance and conductance, thermal conductivity, steady state conduction, heat flow through plane wall, composite wall, cylindrical surface and sphere; convection; individual heat transfer coefficient and overall heat transfer coefficient.

UNIT - II HEAT EXCHANGERS AND HEAT TRANSFER WITH PHASE CHANGE 11 h

Heat exchangers-shell and tube and double pipe heat exchangers, flow arrangements in heat exchangers, energy balance, LMTD, single and multiple effect evaporators; natural and forced circulation evaporators; heat transfer in condensation of single vapour, drop wise condensation and film wise condensation and heat transfer to boiling liquids.

B.Tech. Biotechnology

UNIT - III DIFFUSION AND LIQUID-VAPOUR MASS TRANSFER

Diffusion: Molecular diffusion, Fick's law of diffusion, steady state molecular diffusion in gases and liquids, mass transfer coefficients, theories for the determination of mass transfer coefficients-penetration and surface renewal theories, diffusivity and flux calculations; Simple distillation and continuous rectification- Binary systems, McCabe Thiele analysis and calculations.

UNIT - IV LIQUID-GAS/LIQUID MASS TRANSFER

Absorption: Selection criteria for solvents, material balance, minimum liquid-gas ratio, calculations on circulation rate and composition; design concepts- HTU & NTU concepts, Industrial absorbers – types and characteristics, Liquid-liquid extraction-distribution co-efficient, ternary systems and triangular diagrams, solvent selection criteria for extraction, material balancecalculations-single stage extraction, extraction equipment's.

UNIT-V APPLICATIONS OF HEAT AND MASS TRANSFER INBIOLOGICAL **SYSTEMS**

Heat transfer in bioreactors, relationship between heat transfer, cell concentration and stirring conditions, analogy between heat and mass transfer. Role of diffusion in bioprocess, film theory, Oxygen uptake in cell cultures-oxygen transfer to cell, Oxygen transfer in fermentors and measurement of dissolved oxygen concentration

Total: 50 h

Text Book:

- 1. Gavhane, K.A. (2013). Unit Operations II. 29th edition. Nirali Prakasan Publication, Pune, India.
- 2. Pauline M. Doran. (2013). Bioprocess Engineering principles. 2nd Edition. Elsevier.
- 3. Treybal R.E. (1982). Mass Transfer Operations. 3rd edition. McGraw-Hill, New Delhi, India.

References Books

- 1. McCabe, W.L., and Smith J.C. (1993). Unit Operations of Chemical Engineering. 7th edition. McGraw Hill, Singapore.
- 2. James Bailey & David Ollis (2017), Biochemical Engineering Fundamentals, 2nd Edition, McGraw Hill.

Web References

- 1. https://nptel.ac.in/courses/103103032
- 2. https://nptel.ac.in/courses/103103145
- https://www.researchgate.net/publication/358073978 3.

9 h

CO / PO Mapping														
CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	2	-
Avg.	2.6	1.8	1	-	-	-	-	-	-	-	-	-	2	-

23BTBT602

Biopharmaceutical Technology

Semester - VI 3H-3C

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

Marks: Internal: 40 External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

The goal of this course is for students to

- Explain the basic concepts of Biopharmaceutical Technology.
- Infer the various steps in drug action and mechanism
- Comprehend the different types of drug manufacturing process and application
- Explain the key principles and aspect involved in drug manufacturing process
- Interpret the quality management system and GMP involved in biologic drug production
- Produce novel drugs and biosimilar agents

Course Outcomes

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

- 1. Summarize about the biopharmaceutical drug development and regulatory challenges.
- 2. Understand the key concept in drug action, metabolism and pharmacokinetics
- 3. Infer the important principles in drug manufacturing process
- 4. Illustrate various process and application involved in drug manufacturing process.
- 5. Outline about the facility management for Biopharmaceutical production

UNIT I – DRUG ACTIONS INTRODUCTION TO DRUGS 9h

Generics in Biopharma, definition of biologics, biosimilars, super biologics, differences between chemical genetics and biosimilars, Characteristics of high selling peptides and proteins, developmental and regulatory challenges in biopharmaceutical drug development, Prerequisites for biosimilar development, Biosimilar market potential, small and large molecule protein.

UNIT II -METABOLISM AND PHARMACOKINETICS

Mechanism of drug action; physico-chemical principle of drug metabolism; radioactivity; Pharmacodynamic and pharmacokinetic studies

UNIT III – PRINCIPLE OF DRUG MANUFACTURE

Compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses; coating of tablets; capsule preparation; oral liquids – vegetable drugs –topical application; preservation of drugs; analytical methods and other tests used in drug manufacture; packing techniques; quality management; GMP.

9h

UNIT IV – MANUFACTURE OF DRUGS, PROCESS AND APPLICATION 9h

Process of manufacturing drug; Clean room and its classification, Scale up criteria, SCADA, Process development, production, formulation and sterile packing. Types of reaction process and special requirements for bulk drug manufacture.

UNIT V - CASE STUDIES

Indian companies working in this space and their product pipeline (Biocon, Intas, Dr Reddy's, Reliance, Bharat Biotech, Lupin, Cipla and Shanta); products - Erythropoietin, growth hormone, granulocyte stimulating factors, interferons, streptokinase and monoclonal antibodies.

Total: 45h

Text Books

- 1. Laszlo Endrenyi, Paul Declerck and Shein-Chung Chow. (2017). Biosimilar Drug Development, Drugs and Pharmaceutical Sciences. Volume 216. CRCPress.
- Cheng Liu and K. John Morrow Jr. (2016). Biosimilars of Monoclonal Antibodies: A Practical Guide to Manufacturing, Preclinical and Clinical Development. John Wiley & sons,Inc.

Reference Books

1. Biosimilars: Regulatory, Clinical, and Biopharmaceutical Development. (2018).Germany: Springer International Publishing.

Weblinks

1. https://www.drugs.com/medical-answers/many-biosimilars-approved-unitedstates- 3463281/

	ping													
CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	2	-
Avg.	2	1	-	-	-	-	-	-	-	-	-	-	2.0	-

CO / PO Mapping

Comester VI

		Semester-vi
23BTBT641	Animal & Plant Biotechnology	5H-4C
	(Theory & Lab)	
		1 40 5 1 400

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

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

i) Theory

Course Objectives

The goal of this course is for students to

- Describe the basic view of animal cell culture and scale up.
- Explain the manipulation of embryos and concept of transgenic animals
- Apply the concepts of plant tissue culture for crop improvement
- Illustrate the principles and methods of genetic transformation
- Clarify the basic concept on molecular pharming
- To evaluate and discuss public and ethical concerns over the use of animal biotechnology.

Course Outcomes

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

- 1. Identify the methods to culture animal cell and techniques to scale up.
- 2. Summarize the breeding of farm animals through micromanipulation of embryos.
- 3. Apply the concept of tissue culture for cultivation of plantlets.
- 4. Illustrate the methods of genetic transformation in agrobacterium.
- 5. Make use of the key principles of genetic engineering for the development of animal biotechnology.

UNIT I - ANIMAL CELL CULTURE, GROWTH & SCALE UP 9h

History of Animal Cell Culture, nutritional requirements, Culture Media and Growth Conditions, Primary culture, Suspension Culture, Characterization and maintenance of cell lines, Cryopreservation, Transfection and Transformation of Cells. Growth& Scale up - Need for scaling-up of cells for vaccine or antigen or pharmaceutical protein production, Hybridoma Technology, Cell culture reactors, Scale- Up in suspension andmonolayer cultures.

UNIT II - MICROMANIPULATION OF EMBRYOS & TRANSGENIC ANIMALS 9h

Breeding of farm animals to biopharming - equipments - enrichment of x and y bearing sperms from semen samples – Assisted reproductive Technology in animals, Concept of transgenic animals, Methods of transgene delivery, Animal Pharming, Organ Culture, Regenerative Medicine, Human Embryonic Stem Cell research, Ethical Concerns and Biosafety.

UNIT III - PLANT TISSUE CULTURE

History of plant tissue culture, plasticity and totipotency. Laboratory setup for a typical plant tissue culture facility. Sterilization methods. Types of nutrient media and plant growth regulators in plant regeneration. Pathways for *in vitro* regeneration; protoplast isolation, culture and regeneration; culture of other explants, somatic hybridization; Application of tissue culture for crop improvement. Methods for Plant Conservation, Cryopreservation, synseed production.

UNIT IV - PRINCIPLES AND METHODS OF GENETIC TRANSFORMATION 9h

Introduction to Agrobacterium biology and biotechnology. Mechanism of T-DNA transfer to plants and Agro infection. A. rhizogenes and its application. Transplastomics and its utility. Methods for direct gene transfer, Marker and reporter genes; Promoters used in plant vectors. Plant viral vectors. Molecular techniques for analysis of transgenics. Marker-free transgenics and environmental, social and legal issues associated with transgenic plants. Case studies for genetic engineering in plants for traits of agronomic value, biotic, abiotic stresses and herbicide tolerance.

UNIT V MOLECULAR FARMING

Transgenic crops for production of antibodies, viral antigens and peptide hormones in plants, Edible vaccines and Nutraceuticals. Plant Biotechnology for biofuels. Case studies pertinent to Indian scenario

ii) Laboratory

List of Experiments:

- 1. Preparation and sterilization of standard tissue culture media.
- 2. Sterilization of explants and generation of undifferentiated mass of cells.Regeneration of plants from undifferentiated cells.
- 3. Animal Cell Culture Biosafety and Ethical Concerns
- 4. Preparation of reagents and media for cell culture
- 5. Cell counting and plating
- 6. Maintenance of Adherent (Monolayer) and Suspension Cell culture
- 7. Cell Viability Assay (MTT reagent)
- 8. Cell Cytotoxicity Assay (Trypan Blue Assay)

Text Books:

- 1. Freshney R.I. (2016). Culture of Animal Cells. 7th edition, Wiley-Blackwell.
- 2. George Acquaah. (2007). Principles of Plant Genetics and Breeding. Blackwell Publishing.
- 3. Razdan M.K. (2003). An introduction to Plant Tissue culture. Oxford & IBH Publishing Co,

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2023-2024

Total: 45h

Total: 30h

120

NewDelhi.

4. Adrian Slater, Nigel W. Scott, Mark R. Fowler. (2008). Plant Biotechnology: An Introduction toGenetic Engineering. Oxford University Press.

Reference Books:

- 1. Singh, B., Mal, G., Gautam, S. K., & Mukesh, M. (2019). Advances in Animal Biotechnology.Springer International Publishing.
- 2. Prasad, B. D., Sahni, S., Kumar, P., & Siddiqui, M. W. (Eds.). (2017). Plant Biotechnology, Volume1: Principles, Techniques, and Applications. CRC Press.

Weblinks

- 1. https://www.onlinebiologynotes.com/animal-cell-culture/
- 2. https://www.plantcelltechnology.com/blogadvantages-and-disadvantages-of-plant-tissueculture/

CO / PO Ma	CO / PO Mapping													
CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	1	-	1	1	2
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	2
CO3	3	2	1	-	-	-	-	-	1	1	-	-	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	1	-	-	-	-	-	1	1	-	-	1	2
Avg.	2.6	1.6	1	-	-	-	-	-	1	1	-	1	1	2

Enzymology & Enzyme technology

Semester-VI 5H-4C

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

Marks: Internal: 40 External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

The goal of this course is for students to

- Understand the knowledge on enzyme mechanism of action.
- Explain the production & purification of enzymes.
- Explain about the kinetics of single substrate enzyme action
- Understand the kinetics of multi substrate enzyme action
- Illustrate on immobilization.
- Discuss various application of enzymes that can benefit human life.

Course Outcomes

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

- 1. Outline the enzyme mechanism of action.
- 2. Identify various extraction, purification and characterization of enzymes strategies.
- 3. Experiment with the kinetics of substrate enzyme action.

4. Select suitable enzyme immobilization techniques with respect to its application in bioreactor.

5. Summarize the basics of biosensor using enzyme.

UNIT-I INTRODUCTION TO ENZYMES

Chemical nature, apoenzyme, coenzyme, cofactor, prosthetic group. Nomenclature– IUB system of classification -Six main classes with examples. Mechanisms of enzyme-action; Specificity, type of enzyme specificity, Active site, Models of enzyme action –Lock and key, induced fit, transition statetheory. metal ion catalysis, proximity & orientation. metal-activated enzyme and metalloenzyme.

UNIT-II EXTRACTION, PURIFICATION AND CHARACTERIZATION OF ENZYMES

Production and purification of crude enzyme extracts from plant, animal and microbial sources; methods of characterization of enzymes; development of enzymatic assays.

UNIT-III KINETICS OF MULTISUBSTRATE-ENZYME ACTION

Kinetics of Single substrate reaction – estimation of Michaelis- Menten parameters and Multisubstrate reactions mechanisms; Turnover number; types of inhibition Allosteric regulation of enzymes, Monod - Changeux -Wyman model, pH and temperature effect on

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore – 641 021

9h

9h

9h

120

UNIT- IV ENZYME IMMOBILIZATION

Enzyme immobilization, Physical and chemical methods of immobilization, applications, advantages and disadvantages, Mass transfer in immobilized system Immobilized enzyme bioreactors.

UNIT- V ENZYME ENGINEERING AND BIOSENSORS

Chemical and genetic methods, Property alteration, Prediction of enzyme structure, design and construction of novel enzymes; Ribozymes, Enzyme Biosensor – Classification, Design, Application industry, healthcare, food and environment.

Total: 45 h

ii) Laboratory

List of experiments

- 1. Effect of pH on enzyme activity.
- 2. Effect of temperature on enzyme activity
- 3. Effect of substrate concentration on enzyme activity
- 4. Estimation of Vmax and Km.
- 5. Determination of stability of enzyme activity.
- 6. Production and partial purification of microbial enzymes
- 7. Immobilization techniques such as adsorption, entrapment and encapsulation.
- 8. Enzymatic assay using molar adsorbility

Text Books

- 1. Palmer. T. (2007). Enzymes. Affiliated East West Press Pvt Ltd.
- 2. Wiseman. (1995). Enzyme Biotechnology. Ellis Horwood Publishers.
- 3. Chaplin and Bucke. (1990). Enzyme technology. Cambridge University Press.

Reference Books

- 1. Blanch. H.W. and Clark. D.S. (1996). Biochemical engineering. Marcel Dekker Inc.
- 2. Pye E.K. and Wingard L.B. (1974). Enzyme Engineering II. Plenum Press.
- Singh, S. P., Pandey, A., Singhania, R. R., Larroche, C., & Li, Z. (Eds.). (2020). Biomass, Biofuels, Biochemicals: Advances in Enzyme Catalysis and Technologies. Elsevier.

Weblinks

2023-2024

9h

9h

Total: 30 h

1. https://conductscience.com/introduction-to-enzymology/

CO / PO Mapping

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	-	1	2
CO3	3	2	1	-	-	-	-	-	1	1	-	-	-	2
CO4	3	2	1	-	-	-	-	-	1	1	-	-	1	2
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	2
Avg.	2.4	1.6	1	-	-	-	-	-	1	1	-	-	1	2

23BTMC651University Human Values - I1H - 0C

Instruction Hours/week: L:1 T:0 P:0 Marks: Internal:100 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

- Help students to understand the need, basic guidelines, content and process of value education.
- Help students distinguish between values and skills
- Help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
- Help students understand the meaning of happiness within their selves.
- Help students understand the meaning of happiness and prosperity for a human being.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- 1. Understand the significance of value inputs in a classroom, distinguish between values and skills.
- 2. Understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society
- 3. Distinguish between the Self and the Body; understand the meaning of Harmony in the Self the Co-existence of Self and Body.
- 4. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships.
- 5. Explore their role in ensuring a harmonious society.

UNIT-1 Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit II: Understanding Harmony in the Human Being - Harmony in Myself

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

Unit III: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding harmony in the Family- the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in societyUndivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!

TEXT BOOKS

- 1. R R Gaur, R Sangal and G P Bagaria(2009)."A Foundation Course in Human Values and Professional Ethics"
- 2. 1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
- 3. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
- 4. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
- 5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth Club of Rome's report, Universe Books.
- 6. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
- 7. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
- 8. A N Tripathy, 2003, Human Values, New Age International Publishers.

Semester-VI

23BTBT691MINI PROJECT2H-1C

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

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

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

Semester-VII

Semester-VII

23BTBT701 GENOMICS AND PROTEOMICS

3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Explain the basics of genome organization of prokaryotes and eukaryotes.
- Discuss the effects of cytogenetic mapping.
- Outline the various methods for gene finding and annotations in functional genomics.
- Explain the effects of various protein level estimation in proteomics
- Outline the post translational modification and other protein interactions.
- Discuss the application of proteome analysis

Course Outcomes

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

- 1. Summarize the characteristics of genomic organization of prokaryotes and eukaryotes.
- 2. Evaluate the different physical mapping techniques.
- 3. Discuss the gene findings in functional genomics.
- 4. Explain the protein estimation through different techniques.
- 5. Compare different protein analysis techniques.

UNIT - I OVERVIEW OF GENOMES OF BACTERIA, ARCHAE AND EUKARYOTA 9h

Organization and structure of genomes, Genome size - organization of prokaryotes and eukaryotes, Introns and Exons - gene structure of bacteria, archaebacterial and eukaryotes - Current status of genome sequencing projects - Human genome project, Introduction of functional genomics, proteogenomics and comparative genomics.

UNIT - II PHYSICAL MAPPING TECHNIQUES

9h

Cytogenetic mapping, radiation hybrid mapping, genetic mapping, FISH mapping, STS mapping, SNP mapping optical mapping, Top down and bottom up approach, linking and jumping of clones, gapclosure, pooling strategies, Restriction Enzyme Finger Printing.

B.Tech. Biotechnology

UNIT - III FUNCTIONAL GENOMICS

Introduction to Functional genomics, Microarrays, Serial Analysis of Gene expression (SAGE), Gene finding; annotation; ORF, Tools in ORF and functional prediction; Subtractive hybridization, DNA library screening; differential display and representational difference analysis, TOGA.

UNIT - IV TECHNIQUES IN PROTEOMICS

Introduction to Proteomics. Proteomics and the new biology, level estimation; Edman protein microsequencing; protein cleavage; 2 D gel electrophoresis; metabolic labeling; detection of proteins on SDS gels. Mass spectrometry- principles of MALDI-TOF; Tandem MS-MS; Peptide mass fingerprinting.

UNIT - V PROTEIN PROFILING

Introduction to protein profiling - Post translational modification; protein-protein interactions; glycoprotein analysis; phosphor protein analysis. Application of proteome analysis - Drug Development and toxicology, Pharmaceutical Applications, Proteomics in drug Discovery in human, phage antibodies as tools, Proteomics in Plant genetics and breeding.

Total: 45 h

Text Books

- 1. Brown. T. A. (2019). Genomes, 4th edition. Bios Scientific Publishers Ltd
- 2. Pennington and Dunn. (2001). Proteomics. BIOS Scientific Publishers.

Reference Books

- 1. Livesey. H. (2000). Functional Genomics. Oxford University press.
- 2. Cantor and Smith. (1999). Genomics. John Wiley & Sons.

Weblinks

1. https://www.ebi.ac.uk/training/

CO / PO Ma	CO / PO Mapping													
CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	I	-	-	-	-	-	-	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	2
Avg.	2	1	-	-	-	-	-	-	-	-	-	-	-	2

9h

9h

B.Tech Biotechnology		2022-2023
		Semester-VII
23BTBT702	Bioethics, Biosafety & IPR	3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Disseminate the knowledge on patents, patent regime in India and abroad and registrationaspects
- Outline the current trends in IPR and Govt. supports in promoting IPR
- Classify the role of regulatory committees in controlling the risk.
- Illustrate the biosafety regulations and frameworks in IPR.
- Create patents and copyrights for developed process and products.
- Create public awareness about the benefits of intellectual property among all sections of society.

Course Outcomes

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

- 1. Outline basic knowledge on patent and copyright.
- 2. Summarize the way for developing their idea or innovations.
- 3. Relate role of regulatory committees in controlling the risk.
- 4. Demonstrate enough information on ethical issues linked to research on

animalmodels, transgenics, clinical trials.

5. Illustrate the importance of copy rights and patent.

UNIT-I INTELLECTUAL PROPERTY RIGHTS

Introduction and the need for intellectual property right (IPR) – Types of intellectual property rights - IPR in India : IPR in abroad - Major International Instruments concerning Intellectual Property Rights:–Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP -

UNIT-II BIOSAFETY-REGULATORY FRAMEWORK FOR GMOS IN INDIA & AT INTERNATIONAL LEVEL 9h

Regulatory frameworks in India governing GMOs-Recombinant DNA Advisory Committee (RDAC), Institutional Biosafety Committee (IBSC), Review Committee on Genetic Manipulation, Genetic Engineering Approval Committee (GEAC), Recombinant DNA Guidelines (1990), Revised Guidelines for Research in Transgenic Plants (1998) – Cartagena Protocol on Biosafety – Objectives and salient features of Cartagena Protocol.



UNIT-III IPR-POLICIES

Seed Policy(1988) and Seed Policy (2002), Prevention Food Adulteration Act (1955), The Food Safety and Standards Bill (2005), Plant Quarantine Order (2003), Regulation for Import of GM Products Under Foreign Trade Policy (2006-2007), National Environment Policy (2006). Rules for the manufacture, use/import/export and storage of hazardous microorganisms/genetically engineered organisms or cells (Ministry of Environment and Forests Notification, (1989). Convention of Biological Diversity (1992).

UNIT-IV BIOETHICS

Patenting live microorganism, Human Genome project and ethical issues, Animal cloning, . Experimenting on animals, Public education of producing transgenic organism, legal and socioeconomic impacts of biotechnology, testing drugs on humanvolunteers, Hazardous materials used in biotechnology, their handling and disposal.

UNIT- V CASE STUDIES

IPR in current scenario with case studies.- Copyright and related rights - Trade Marks - Industrial design and Integrated circuits - Geographic indications - Protection against unfair competition.

Text Books

- 1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India. Cengage Learning India Private Limited.
- 2. Neeraj P., & Khusdeep, D. (2014). Intellectual Property Rights. India. PHI learning Private Limited.

Reference Books

- 1. V Sreekrishna. (2017). Bioethics and Biosafety in Biotechnology. New AgeInternational publishers.
- 2. Nambisan, P. (2017). An introduction to ethical, safety and intellectual propertyrights issues in biotechnology. Academic Press.

Weblinks

- 1. http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
- 2. <u>https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipopub_489.pdf</u>

9h

9h

9h

Total: 45 h

CO/POM	CO / PO Mapping													
CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CO2	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CO4	2	1	-	-	-	-	-	1	-	-	-	-	2	-
CO5	2	1	-	-	-	-	-	-	-	-	-	1	2	1
Avg.	2	1	-	-	-	-	-	1	-	-	-	1	2	1

			Semester-VII								
23BTBT741	Biosepara	5H-4C									
(Theory & Lab)											
Instruction Hours/ week:	L: 3 T: 0 P: 2	Marks: Intern	nal: 40 External: 60 Total: 100								
]	End Semester Exam: 3 Hours								

Course Objectives

- The goal of this course is for students to
- Explain the basics of separation of biomolecules.
- Illustrate the primary separation and isolation of biomolecules.
- Summarize the techniques of product recovery and concentration.
- Outline the various methods of product purification.
- Apply the biosepration concepts in final product purification and product polishing.

Course Outcomes

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

- 1. Outline the fundamentals of separation of biomolecules and various cell disruption techniques.
- 2. Identify various primary separation and biomolecules isolation techniques.
- 3. Summarize the principles of adsorption, extraction and membrane separation process to recover products.
- 4. Make use of the principles of various chromatographic techniques to purify biomolecules.
- 5. Apply various drying and crystallization methods for product purification and polishing.

UNIT - I - INTRODUCTION TO SEPARATION OF BIOMOLECULES 9h

Introduction to separation of biomolecules and its importance in Biotechnology - characteristics of biomolecules - physico chemical basis of bioseparation - location of products and product release kinetics - cell disruption methods: importance of cell disruption in product release, mechanical, chemical and enzymatic process; pretreatment and stabilization of bioproducts.

UNIT - II - PRIMARY SEPARATION AND ISOLATION 9h

Basic separation technices ; Sedimentatiom , centrifugation, ultracentrifugation, Principle of batch filtration - pretreatment of fermentation broth, design of industrial filters: plateand frame filter press, leaf filter, continuous filtration, Fouling problems: rotary drum filter – working principles of centrifugation - centrifugation-based methods for separation of the cell

organelles and biomolecules (DNA, RNA, Proteins and secondary metabolites) - separation of different types of DNA from cells, Separation of the different types of RNA from biological samples.

UNIT - III - PRODUCT RECOVERY AND CONCENTRATION

Adsorption: isotherms, adsorption column dynamics, adsorption in batch, CSTR and fixed bed - problems in adsorption isotherms and break point time in fixed bed adsorption - principle of cloud point, aqueous two phase and supercritical fluid extraction - membrane separation processes: microfiltration, ultrafiltration, reverse osmosis and dialysis, precipitation of proteinsby different methods.

UNIT - IV - PRODUCT PURIFICATION

Basics of chromatography and its use in separation of biomolecules - thin-layer, ion exchange, size exclusion, GLC, bioaffinity, hydrophobic interaction, reverse phase, pseudo affinity chromatography, high performance liquid chromatography, flash chromatography and gas chromatographic techniques.

UNIT - V - FINAL PRODUCT PURIFICATION AND POLISHING 9h

Crystallization: nucleation, crystal growth, crystal size distribution, kinetics of crystallization, industrial crystallizers, recrystallization; lyophilzation, chemistry of extraction, use of solvent extraction in antibiotic separation, drying - drying terminologies, drying curve, industrial dryers, spray dryer, fluid dryer/ drum dryer, freeze drying principles and applications - problems related to relative humidity and population density. **Formulation strategies**: Importance of formulation, formulation of Enzymes and pharmaceutical products.

Total: 45 h

ii) Laboratory List of experiments

- 1. Cell disruption by Sonication
- 2. Cell disruption by enzymatic method
- 3. Cell fractionation and isolation of chloroplasts by differential centrifugation
- 4. Isolation of casein from milk (Isoelectric precipitation)
- 5. Precipitation of protein by salting out (Ammonium sulphate precipitation)
- 6. Aqueous two-phase extraction of protein
- 7. Adsorption Studies
- 8. Separation of the proteins with suitable chromatography methods
- 9. Crystallization
- 10. Drying

Total: 30h

9h

Text Books:

- 1. Nooralabettu Krishna Prasad. (2012). Downstream Process Technology A New Horizon in Biotechnology. PHI Learning Private Limited, New Delhi.
- 2. Sivasankar B. (2006). Bioseparations Principles and Techniques. Prentice Hall of India Private Limited, New Delhi.
- 3. Roger. G, Harrison, Paul Todd, Scott R. Rudge and Demetri P. Petrides. (2003). Bioseperation Science and Engineering. Oxford University Press, Newyork.

Reference Books

1. Belter P. A., Cussler E.L. and Wei-Houhu. (1988). Bioseparations – Downstream Processing for Biotechnology. Wiley Interscience Pub., New Delhi.

Web links:

1. https://nptel.ac.in/courses/102/106/102106022/

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	-	-	2
CO3	3	2	1	-	1	-	-	-	1	1	-	-	-	2
CO4	3	2	1	-	1	-	-	-	1	1	-	-	-	2
CO5	3	2	1	-	1	-	-	-	1	1	-	1	-	2
Avg.	2.8	1.4	1	-	1	-	-	-	1	1	-	1	-	2

CO / PO Mapping

		Semester-VIII	
Project W	ork Phase - I	8H-4 C	
0 T: 0 P: 4	Marks: Internal: 40 E	xternal: 60 Total: 100	
	End Se	mester Exam: 3 Hours	
	Project W 0 T: 0 P: 4	Project Work Phase - I D T: 0 P: 4 Marks: Internal: 40 E End Se	

Objective: To synthesize and apply the knowledge gained over the engineering programme to solve real world problems.

Guidance/Remarks: Project-I can be done either during the Summer Break between Semester VI and Semester VII or during the Semester VII. It will be evaluated as part of Semester VII. It may either be a complete project related to the field of Biotechnology or it may be an initiation (Phase I) of Project-II present in Semester VIII, provided the "Project Work II" is expected to extend beyond the duration of 6 months.

SEMESTER VIII Semester-VIII 23BTBT891 Project Work Phase – II 16H-8C Instruction Hours/ week: L: 0 T: 0 P: 16 Marks: Internal: 120 External: 180 Total: 300 End Semester Exam: 3 Hours

Objective: To synthesize and apply the knowledge gained over the engineering programme to solve real world problems.

Guidance/Remarks: Project-II has to be done during Semester VIII. It may be initiated in the break between Semester VII & VIII although it is not mandatory to initiate in the break. It will be evaluated as part of Semester VIII. It may either be a complete project related to the field of Biotechnology or it may be an extension (Phase II) of Project-I present in Semester VII, provided the Project in charge agrees that "Project Work I" is worthy enough to extend across two semesters (i.e. VII & VIII). It may also be a startup in the field related to Biotechnology. In the case of startups, substantial evidence has to be produced for evaluation of the work carried out as part of Project-II
PROFESSIONAL ELECTIVES

SEMESTER IV

ELECTIVE - I

23BTBT4E01

ENVIRONMENTAL BIOTECHNOLOGY

Semester - IV **3H-3C**

Marks: Internal: 40 External: 60 Total: 100

End Semester Exam: 3 Hours

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

Course Objectives

The goal of this course is for students to

- Explain basic knowledge on soil microbes and its characteristics.
- Demonstrate the effects of xenobiotic compounds.
- Discuss various methods for industrial waste water management.
- Explain the effects of various industrial wastes and to infer basic concepts for its management.
- Outline the natural and engineered bio-treatment methods to remediate the pollutants.
- Discuss the developments pertaining to environmental biotechnology.

Course Outcomes

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

- 1. Summarize the characteristics of soil microbes and its interactions.
- 2. Illustrate the different xenobiotics present and methods to degrade them.
- 3. Describe the industrial waste management systems.
- 4. List the opportunities in waste treatment industries and its management.
- 5. Outline the natural and engineered bio treatment methods to remediate pollutants.

UNIT - I INTRODUCTION

Microbial flora of soil, growth and ecological adaptations of soil microorganisms, interactions among soil microorganisms - biogeochemical role of soil microorganisms. Role of microbes in improving soil fertility

UNIT - II DEGRADATION OF XENOBIOTIC COMPOUNDS

Common xenobiotics- contaminants and pollutants -Soil, Air and water; Degradation vs Bioremediation; Bioremediation -strategies, types, Advantages and disadvantages; Role of GEMS in degradation of xenobiotics; Case study on degradation pattern of xenobiotics

9h

UNIT - III INDUSTRIAL WASTE WATER MANAGEMENT

Wastewater characteristics - physical, chemical and biological, Biological processes - unit operations, aerobic treatment processes, activated sludge process - characteristics of activated sludge and process configuration, anaerobic treatment by methanogenesis

UNIT - IV TREATMENT OF INDUSTRIAL WASTE

Dairy, Paper & Pulp, Textile, leather, hospital and pharmaceutical industrial waste management, ewaste-radioactive and nuclear power waste management, Case study

UNIT - V DEVELOPMENTS PERTAINING TO ENVIRONMENTAL BIOTECHNOLOGY 9h

Bioindicators, Biomarkers, Solid waste management, Role of biosensors in Environmental monitoring, Heavy metal pollution and their control strategies, Prevention of environmental damage with respect to nitrogen fixation, Bioremediation, Production of bioelectricity from microbial fuel cell (MFC), Improvement of water quality by denitrification.

Total: 45 h

Text Books

- 1. Scragg. A. H. (2005). Environmental Biotechnology. Oxford University press.
- 2. Rittmann. B. E. and Mccarty. L. P. (2001). Environmental Biotechnology: Principle and Applications. McGraw Hill.

Reference Books

- 1. Chatterji. A.K., (2003). Introduction to Environmental Biotechnology. Prentice Hall of India Pvt. Ltd., New Delhi.
- 2. Prescott. M., Harley. J. P. and Klein. D. A. (2008). Microbiology. Boston. McGraw-Hill Higher Education.
- 3. Singh, A., Srivastava, S., Rathore, D., & Pant, D. (Eds.). (2020). Environmental Microbiology and Biotechnology: Volume 1: Biovalorization of Solid Wastes and Wastewater Treatment. Springer Singapore, Imprint: Springer.

Web links

https://www.sciencedirect.com/book/9780124077768/environmental-biotechnology

9h

CO-PO MAPPING

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	2
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	2
Avg.	2	1	-	-	-	-	-	-	-	-	-	1	1	2

23BTBT4E02

GENETICS AND CYTOGENETICS

Semester - IV 3H-3C

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

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

Course Objective

The goal of this course is for students to

- Interpret the Mendelian Principle and experiments
- Discuss the fundamentals of cytogenetics.
- Getting familiarized with the common chromosomal aberrations and their evolutionary consequences.
- Understand the basics of cell cycle and cell division.
- Learn about basic techniques involve in cytogentetics.
- Discuss the commonly used techniques for the identification of genes.

Course Outcomes

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

- 1. Summarizes the chemical basis of heredity
- 2. Discuss the basic concepts related to mutation and cytogenetic
- 3. Outline the techniques used for identifying common genetic aberrations in cell.
- 4. Infer the human genetics and the disorder using modern techniques.
- 5. Explain the concept about the chromosomal alleles present in cell.

UNIT-I: MENDELIAN PRINCIPLE AND EXPERIMENTS

Mendelian inheritance-principles; Mendel's experiments-monohybrid, dihybrid, trihybrid and multihybrid crosses. Interaction of genes: dominance, incomplete dominance, codominance, over dominance, epistasis, complementary genes, duplicate genes, polymeric genes, modifying genes; lethal genes. Multiple alleles; Sex determination; Extra chromosomal inheritance. Gene concept: Concept of allelism (Factors, alleles, multiple alleles, pseudoalleles).

UNIT-II FUNDAMENTALS OF CYTOGENETICS

Mutation, types of mutations (Sponteneous, Induced, Base substitutions and frameshifts - Transitions, Transversions, gain in function, loss in function, Neutral mutations), Molecular mechanism of mutations (Base analogs, alkylating agents); Detection of mutations : Dominant lethal test, Sex-linked recessive lethal test, translocations, Ames test, P-mediated mutagenesis, Cytogenetic effects of ionizing and nonionizing radiations, Linkage and construction of genetic maps: Cytogenetic and linkage maps, Two and threepoint cross in Drosophila, RFLP mapping.

9h

B.Tech. Biotechnology

UNIT –III MOLECULAR MECHANISM OF CELL DIVISION

Molecular mechanism of cell division: Amitosis, Endomitosis and Mitosis, Ultra structure and organization of centrosome, centromere, Kinetochore, Microtubules and their dynamic instability, Microtubule Associated proteins, Anaphasic movements, Cytokinesis. Molecular organization of eukaryotic chromosomes, Telomeres, Karyotyping and its importance. Molecular mechanism of sex determination in Drosophila and man; Human genetics disorders, extra- chromosomal inheritance.

UNIT -IV MOLECULAR GENETICS

Polyploidy: Classification, cytological and genetical method of identification of auto polyploids and allopolyploids. Classification, method of production, identification and meiotic behavior of aneuploids (Monosomics, Nullisomics and trisomics). Structural alteration in chromosome: Deletion, Duplication, Inversion & Translocation, hetrozygote.

UNIT V TECHNIQUES IN GENETICS

Concept of gene, genetic load & genetic counselling, Transfer of individual whole Chromosome-Alien addition lines, alien substitution lines, chromosomal painting, chromosomal jumping, chromosomal walking; Artificial chromosome construction and its uses, Reversion of autopolyploids to diploids; genomemapping in polyploids. In situ hybridization-concept & techniques, flow cytometry in karyo type analysis.

Text Books

- 1. Stickberger, M.W., (2015) Genetics, 3rd edition, Pearson Education India.
- 2. Jocelyn E.Krebs (2017)Lewin's Gene XII, Burlington, MA : Jones & Bartlett Learning.

Reference Books

- 1. Eldon John Gardner, (2016) Genetics, 6th edition, Wiley publication.
- 2. Armin Basler, Günter Obe (2014), Cytogenetics: Basic and Applied Aspects, Springer Berlin-Heidelberg.

Websites

https://www.genome.gov/genetics-glossary/Cytogenetics

CO-PO MAPPING

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	1	1	2
CO2	2	1	-	1	-	-	-	-	-	-	-	-	-	2
CO3	2	1	1	-	1	-	-	-	-	-	-	-	1	2
CO4	2	1	-	-	1	-	-	-	-	-	-	-	-	2
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	2
Avg.	2	1	1	1	1	-	-	-	-	-	-	1	1	2

2023-2024

9h

9h

9h

Total : 45 h



Semester - IV

23BTBT4E03 WASTE MANAGEMENT AND UPCYCLING 3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Explain the fundamental aspects of types of waste and its management.
- Disseminate the knowledge on various current waste management technologies.
- Discuss various advance strategies for the management of waste.
- Outline the concepts of handling and recycling wastes.
- Develop knowledge on how waste can be converted to wealth in a sustainable way.
- Think in an innovative way to develop concepts in waste management.

Course Outcomes

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

- 1. Summarize the basic ideas on waste and its sustainable management.
- 2. List the modern technologies for waste management.
- 3. Illustrate the safety guidelines of waste management.
- 4. Outline the basic ideas on landfill techniques.
- 5. Apply the concepts in managing waste in various sectors.

UNIT - I WASTE MANAGEMENT

The definition of waste, and its classification in the context of EU legislation, policy and other drivers for change, including the planning and permitting regime for the delivery of waste management solutions. Liquid & solid waste collection, treatment and disposal systems: Segregation and mixing schemes; Pre-treatment and its role in the industrial wastemanagement; Overview of wastewater treatment technologies and development of waste treatment schemes; Operation and maintenance of treatment plants; and Case study of an industrial waste management system.

UNIT - II TECHNOLOGIES FOR WASTE TREATMENT

Waste incineration and energy from waste, pyrolysis and gasification, anaerobic digestion, composting and mechanical biological treatment of wastes, Biocatalytic waste treatment, Advance oxidation process, managing biomedical waste.

UNIT - III HANDLING AND RECYCLING TECHNIQUES

Health considerations in the context of operation of facilities, handling of materials and impact of outputs on the environment; Advances in waste recycling and recovery technologies to deliver added value products; Landfill engineering and the management of landfill leachate and the mining of old landfills. Hazardous effects of landfill leachate.

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore – 641 021

9h

9h

9h

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UNIT - IV TOOLS FOR WASTE MANAGEMENT

Interface of waste and resource management and biotechnology in the context of sustainable waste management in global cities and developing countries; and Use of decision support tools including multi-criteria analysis, carbon foot-printing and life- cycle analysis, as appropriate.

UNIT - V SUSTAINABLE WASTE MANAGEMENT

Laws of sustainable waste management, Waster Upcycling, waste reuse, Waste down cycling, waste upcycling a social enterprise, Case study each area. Innovative technologies for sustainable waste management.

Total : 45 h

Text Books

- 1. Chinnappan B., (2022), Handbook of Solid Waste Management, Springer Publication.
- 2. Gupta O.P. (2019). Elements of Solid & Hazardous Waste Management. Khanna Publishing House, New Delhi.

Reference Books

- 1. Chen., (2018), Handbook of advanced Industrial and Hazardous wastes management, CRC Press.
- 2. Bilitewski B., HardHe G., Marek K., Weissbach A., and Boeddicker H. (1994). Waste Management. Springer.
- 3. George Tchobanoglous et.al. (1993). Integrated Solid Waste Management. McGraw-Hill Publishers.

Website:

https://www.roadrunnerwm.com/blog/the-5-rs-of-waste-recycling

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	1	-	-	-	-	-	-	2
CO2	2	1	-	-	1	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	1	-	-	-	-	1	1	2
CO4	2	1	-	-	-	-	1	-	-	-	-	1	1	2
CO5	3	2	1	-	1	1	1	-	-	-	-	1	1	2
Avg.	2.2	1.2	1	-	1	1	1	-	-	-	-	1	1	2

CO-PO MAPPING

9h

2023-2024

23BTBT4E04

FOOD BIOTECHNOLOGY

Semester - IV **3H-3C**

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

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

Course Objectives:

The goal of this course is for students to

- Basic concepts of food biotechnology
- Impart knowledge on various foods and its nutritional values
- Learn the constituents and additives present in the food.
- Gain knowledge about the microorganisms, which spoil food and cause food borne diseases.
- Familiarize different techniques used for the preservation of foods.

Course Outcomes:

Through this subject the student will be able to:

- 1. Outline the fundamentals of food processing and preservation
- 2. Summarizes with the functional properties of Carbohydrates, fats, lipids, proteins in food
- 3. Infer the knowledge about the importance of food additives and their function
- 4. Explain, analyze and evaluate scenarios related to various unit operations in food processing and preservation
- 5. Illustrate the spoilage and deterioration mechanism in food and methods to control deterioration and spoilage.

UNIT I FOOD AND NUTRIENTS

Constituents of food - carbohydrates, lipids, proteins, water, vitamins and minerals, dietary sources, role and functional properties in food, contribution to organoleptic and textural characteristics, nutrigenetics.

UNIT II FOOD ADDITIVES

Classification, intentional and non-intentional additives, functional role in food processing and preservation; food colourants - natural and artificial; food flavours; enzymes as food processing aids, food adulterants and their detection, Introduction to food safety and security.

UNIT III MICROORGANISMS ASSOCIATED WITH FOOD

Bacteria, yeasts and molds - sources, types and species of importance in food processing and preservation; fermented foods and food chemicals- Dairy products, Fruits and vegetable products and single cell protein; Probiotics and alternative microbial nutrients

UNIT IV FOOD SPOILAGE AND FOOD BORNE DISEASES

Food spoilage and its types, Factors responsible for spoilage, spoilage of vegetables, fruits, meat, poultry, beverage and other food products. Classification of food borne disease-Infections -bacterial and other types; Food intoxications and poisonings - bacterial and non-bacterial

9h

9h

9h

141

9h

UNIT V FOOD PROCESSING AND FOOD PRESERVATION

Principles of food preservation, Preservation by high temperature- sterilization, pasteurization and blanching, thermal death curves of microorganisms, canning; Preservation by low temperature- frozen storage, freezing characteristics of foods, microbial activity at low temperatures, factors affecting quality offoods in frozen storage; Irradiation method of foods. Preservation, Food packing, Certifications for food products

Total: 45 h

Text Books

- 1. T.P. Coultate Food The Chemistry Of Its Components, 2nd Edn. Royal Society, London, 1992.
- B. Sivasanker Food Processing And Preservation, Prentice-Hall Of India Pvt. Ltd. New Delhi 2002.

Reference Books

- W.C. Frazier And D.C. Westhoff Food Microbiology, 4th Ed., Mcgraw-Hill Book Co., New York 1988.
- 2. J.M. Jay Modern Food Microbiology, Cbs Pub. New Delhi, 1987.

Website

1. http://www.niftem-t.ac.in/food_biotechnology.php

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO3	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO4	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	2	1
Avg.	2	1	-	-	-	-	-	-	-	-	-	-	2	1

CO-PO MAPPING

SEMESTER V ELECTIVE – II

Semester - V

23BTBT5E01 GOOD MANUFACTURING AND LABORATORY PRACTICE 3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Outline the requirements and guidelines of GLP and GMP.
- Describe the duties of key personnel in GLP and GMP.
- Record the basic notion on production area and documentation types in GMP.
- Discuss the basic theory of Quality Control and various testing methods.
- Apply GMP and GLP for the biotech based products and process.
- Have the confidence to outline the main GMP requirements related to premises, storage facilities and personnel.

Course Outcomes

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

- 1. Infer the requirements for GMP and GLP.
- 2. Summarize the upgraded personnel to maintain GMP.
- 3. Outline diverse properties production area and equipment.
- 4. Recall the design for the correct documentation.
- 5. Apply the knowledge on quality control department.

UNIT - I INTRODUCTION AND GUIDELINES

Introduction to GMP and GLP, Basic requirements of GMP and GLP compliance for regulatory approval, importance of GMP, Principles of quality by design (QBD), Introduction to the concept of Design of Experiment (DOE), WHO guidlines on GLP and GMP-Introduction to ICH guidelines and their usage. Drug Development & Approval Process, Regulation of Clinical and Preclinical Studies, Formulation, Production Management, Authorization and marketing of drugs.

UNIT - II PERSONNEL

Key personnel, background and duties of the qualified person, duties of the head of the production department, duties of the head of quality department, person releasing the batch, consultants, personnel training and hygiene, Ethics in manufacturing of control.

9h

UNIT - III PREMISES AND DOCUMENTATION

Premises, production area, storage area, quality control areas, ancillary areas, equipment, Generation and control of documents, types of documents and specifications, procedures and records, Computer simulation on process design.

UNIT - IV PRODUCTION AND QUALITY CONTROL

General principles, prevention of cross contamination in production, Quality control – principles, main tasks of QC department, technical transfer of testing methods, transfer protocol.

UNIT - V CASE STUDY

Principle of QBD and DOE in pharmaceutical quality system, principle and DOE approaches in medical devices, principle of QBD and DOE in human cell tissue products, principle of QBD and DOE in biological products.

Text Books

- 1. Emmet P. Tobin. (2016). cGMP starter guide: Principles in Good Manufacturing Practices for Beginners. Createspace Independent Publishing Platform.
- 2. B Cooper. (2017). Good Manufacturing Practices for Pharmaceuticals: GMP in Practice. Createspace Independent Publishing Platform.

Reference Books

- 1. Sarwar Beg and Md Saquib Hasnain. (2019). Pharmaceutical Quality by design: Principles and application. Academic press.
- 2. N Politis S, Colombo P, Colombo G, M Rekkas D. (2017). Design of experiments (DoE) in pharmaceutical development, Drug Dev Ind Pharm., 43(6):889-901.
- 3. Andrew Teasdale, David Elder, Raymond W. Nims. (2017). ICH quality guidelines-An implementation guide.

Weblink

1. https://www.ich.org/page/ich-guidelines

CO-PO MAPPING

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	1	-	-	-	1	-	-	-	-	-	1	2	-
CO3	2	1	-	-	1	-	-	-	-	-	-	-	2	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	1	-	-	1	-	-	-	-	-	1	2	-
Avg.	2.2	1.2	1	-	1	1	-	-	-	-	-	1	2	-

9h

9h

144

2023-2024

23BTBT5E02FUNDAMENTALS OF NANOBIOTECHNOLOGYSemester - V3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Explain basic knowledge on nanotechnology.
- Demonstrate the structural and functional principles of bionanotechnology.
- Discuss various methods for microfluidic components.
- Explain the effects of various protein and DNA based nanostructures.
- Outline the basic concepts of nanoparticles in cancer therapy.
- Discuss the applications in nanoscale technology.

Course Outcomes

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

- 1. Summarize the characteristics different nanoparticles.
- 2. Evaluate the different structural and functional principles of biotechnology.
- 3. Illustrate the basic of nanostructures.
- 4. Outline the protein and DNA basis of nanoparticle.
- 5. Identify and list different nanoparticles for cancer therapy.

UNIT - I INTRODUCTION TO NANOTECHNOLOGY

Background and definition of nanotechnology, chemical bonds in nanotechnology - Scales at the bionano interface –Basic capabilities of nanobiotechnology and nanomedicine – Biological tradition and mechanical tradition biotechnology – Applications of Nanotechnology in biotechnology.

UNIT II - NANO PARTICLES

Introduction, Types of Nanoparticles, Techniques to Synthesize Nanoparticles, Characterization of Nanoparticles, Applications, Toxic effects of Nanomaterials, Significance of Nanoparticles Nanofabrications- MEMS/NEMS, Atomic Force Microscopy, Self assembled monolayers/ Dip- pen Nanolithography, Soft Lithography, PDMS Molding, Nano Particles, Nano wires and Nanotubes.

UNIT - III MICROFLUIDICS

Concepts and advantages of microfluidic devices - Materials and methods for the manufacture of microfluidic component - Fluidic structures - Surface modifications - Lab-on-a-chip for biochemical analysis, Nano printing of DNA, RNA, and proteins biochips applications in nano scale detection.

9h

9h

UNIT - IV PROTEIN AND DNA BASED NANOSTRUCTURES

S-Layers - Engineered nanopores - Microbial nanoparticle production - DNA-Protein nanostructures - Biomimetic fabrication of DNA based metallic nanowires and networks, ,Nano biosensors for protein and DNA detection- DNA-Gold nanoparticle conjugates - Nanoparticles as non-viral transfection agents.

UNIT - V NANOPARTICLES IN CANCER THERAPY

Magnetic nano and microparticles for embolotherapy - hyperthermic therapy - delivery of chemotherapeutic drugs-brachytherapy, Thermoresponsive liposomes for hyperthermic chemotherapy assemblies and ultrasound activation. Nanotechnology in Biomedical Application: micro- and Nano electromechanical devices in drug delivery.

Text Books :

- 1. Shoseyov. O. and Levy. I. (2007). Nanobiotechnology: Bioinspired Devices and Materials of the future. Human Press.
- 2. Bhushan, B.(2017). Springer Handbook of Nanotechnology. Springer-Verlag Berlin Heidelberg.
- 3. Freitas. R. A. (2004). Nanomedicine. Landes Biosciences.

Reference Books

- 1. Kohler. M. and Fritzsche. W. (2004). Nanotechnology-An Introduction to Nanostructuring Techniques. Wiley VCH.
- 2. Niemeyer. C. M. and Mirkin. C. (2004). A Nanobiotechnology: Concepts, Applications and Perspectives. Wiley-VCH.

Weblink

1. https://www.nanowerk.com/nanobiotechnology.php

CO-PO MAPPING

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	2
CO3	2	1	-	-	1	-	-	-	-	-	-	-	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	1	-	1	-	-	-	-	-	-	1	-	2
Avg.	2.2	1.2	1	-	1	-	-	-	-	-	-	1	1	2

9h

Total: 45 h

9h

146

23BTBT5E03

PROTEIN ENGINEERING

Semester - V 3H-3C

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

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

Course objectives:

The goal of this course is for students to

- Understand the basics of chemical bondings in protein
- Know about the structure, characteristics and functions of amino acids
- Understand the hierarchy in protein structure
- Understand and unravel the concepts of major protein molecules in all cells
- Know about the catalytic design of protein molecules

Course outcomes:

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

- 1. Outline the importance of protein biomolecules.
- 2. Infer the basic characteristics of proteins
- 3. Illustrate the various interactions in protein makeup.
- 4. Summarize structure and function relationship of protein.
- 5. Apply the basic principles of proteins in various field of study.

UNIT I: BONDS AND ENERGIES IN PROTEIN MAKEUP

Covalent, Ionic, Hydrogen, hydrophobic and Vander walls interactions in protein structure. Interaction with electromagnetic radiation (radio, micro, infrared, visible, ultraviolet, X-ray) and elucidation of protein structure.

UNIT II: AMINO ACIDS AND THEIR CHARACTERISTICS 9h

Amino acids – structure with three and single letter codes- molecular properties (size, solubility, charge, pKa), Chemical reactivity in relation to post-translational modification (involving amino, carboxyl, hydroxyl, thiol, imidazole groups) and peptide synthesis.

UNIT III: PROTEIN ARCHITECTURE

Peptide mapping, peptide sequencing - automated Edman method & mass-spec. Methods to determine Super-secondary structure: Apha-turn-alpha, beta-turn-beta (hairpin), beta-sheets, alpha-beta-alpha, topology diagrams, up and <u>down</u> & TIM barrel structures nucleotide binding folds, prediction of substrate binding sites. overview of methods to determine 3D structures, Modular nature, formation of complexes.

UNIT IV: STRUCTURE-FUNCTION RELATIONSHIP

DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, Trp repressor, Eucaryotic transcription factors, Zn fingers, helix-turn helix motifs in homeodomain, Leucine zippers, Membrane proteins and receptors bacteriorhodopsin and Photosynthetic reaction center, Immunoglobulins: IgG Light chain and heavy chain architecture, abzymes and Enzymes:

9h

9h

1.4

Serine proteases, understanding catalytic design by engineering trypsin, chymotrypsin and elastase,

UINT V: PROTEIN ENGINEERING

Advantages – protein data base analysis – methods to alter primary structure of proteins, examples of engineered proteins, thermal stability of T4-lysozyme, recombinant insulin to reduce aggregation and inactivation, *de novo* protein design – principles and examples.

Text Books

- 1. Voet D. and Voet G., "Biochemistry", Third edn.John Wiley and Sons, 2001.
- 2. Moody P.C.E. and Wilkinson A.J. "Protein Engineering", IRL Press, Oxford, UK, 1990.

Reference Books

- 1. Branden C. and Tooze J., "Introduction to Protein Structured", Second Edition, Garland Publishing, NY, USA, 1999
- 2. Creighton T.E. "Proteins", Freeman WH, Second Edition, 1993.

3. Huimin Zhao. (2021). Protein Engineering: Tools and Applications. Wiley-VCH

Weblink

1. https://academic.oup.com/peds

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COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	1	1	2
CO2	2	1	-	-	-	-	-	-	-	-	-	1	1	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	1	-	-	-	-	-	-	-	-	-	1	2
Avg.	2.2	1.2	1	-	-	-	-	-	-	-	-	1	1	2

CO-PO MAPPING

B.Tech. Biotechnology

23BTBT5E04

BIOENERGY AND BIOFUEL

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

COURSE OBJECTIVES

The goal of this course is for students to

- Understand the basic of biomass chemistry
- Explain the important strategies for the production of ethanol
- Outline various valorization strategies for the production of biofuel
- Explain the alternative biofuels production
- Highlight the importance of biomass and biofuel

COURSE OUTCOMES

Upon completion of this course, students will be able to

- 1. Summarize the important properties of biomass.
- 2. Outline the bioenergy systems and their potential in future energy supply.
- 3. Demonstrate biomass an inexpensive feedstock as sustainable and renewable energy.
- 4. Compare the fossil-based products with biodiesel.
- 5. Identify other alternate energy resource and their applications.

UNIT I INTRODUCTION

Cellulosic biomass availability and its contents lignocellulose as a chemical resource, Physical and chemical pretreatment of lignocellulosic biomass, Cellulases and lignin degrading enzymes.

UNIT II ETHANOL

Ethanol as transportation fuel and additive; bioethanol production from carbohydrates; engineering strains for ethanol production from variety of carbon sources to improved productivity.

UNIT III BIODIESEL

Chemistry and Production Processes; Vegetable oils and chemically processed biofuels; Biodiesel composition and production processes; Biodiesel economics; Energetics of biodiesel production and effectson greenhouse gas emissions Expanding biodiesel production.

UNIT IV OTHER BIOFUELS

Biodiesel from microalgae and microbes; biohydrogen production; biorefinery concepts-Biobutanol,Biopropanol, bioglycerol – Principles, materials and feedstocks - Process technologies and techniques-Advantages and Limitations.

UNIT V APPLICATIONS OF BIOFUELS

Life cycle environmental impacts of biofuels and co products – Environmental sustainability of biofuels – Energy security and supply, Economic sustainability of biofuel

Total: 45 h

9h

9h

9h

9h

9h

149

2023-2024

3H-3C

Semester-V

End Semester Exam: 3 Hours

Text Books

- 1. Gupta. V. K. and TUOHY. M. g. Biofuel Technologies, Springer, 2013.
- 2. Luque, R., Campelo, J.and Clark, J. Handbook of biofuels production, Woodhead Publishing

Limited2011.

Reference Books

- 1. Moheimani, N. R., Boer, M, P, M, K, Parisa A. and Bahri, Biofuel and Biorefinery Technologies, Volume 2, Springer, 2015.
- 2. Lee, Sunggyu; Shah, Y.T. "Biofuels and Bioenergy". CRC / Taylor & Francis, 2013.

Weblink

1. https://www.eesi.org/topics/bioenergy-biofuels-biomass/description

CO-PO MAPPING

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	1	-	-	-	-	1	-	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	1	-	-	-	-	-	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	2
Avg.	2.2	1.2	1	-	-	-	1	-	-	-	-	1	-	2

ELECTIVE – III

Semester - V 3H-3C

23BTBT5E05GENE EXPRESSION AND TRANSGENICS3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Explain the use of different gene expression systems.
- Outline the over expression of recombinant proteins and protein complexes for different applications.
- Understand purification of proteins expressed in different expression systems.
- Outline the hazardous biological materials and the risks associated with them.
- Explain the applications of transgenics.

Course Outcomes

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

- 1. Outline the tools and strategies used in gene expression studies.
- 2. Summarize the applications of transgenics in industrial perspective
- 3. Apply gene expression in microbial and eukaryotic Systems.
- 4. Identify various applications of gene expression studies.
- 5. Analyze the biosafety measures and ethical issues.

UNIT - I INTRODUCTION

Role of genes within cells, genetic elements that control gene expression, Overview of recombinant protein expression vectors and promoters: Vectors with tags His, GST, MBP, GFP. Cleavable tag and non-cleavable tags. Vectors for tag free protein expressions. Over-expression of integral membrane proteins.

UNIT - II GENE EXPRESSION IN PROKARYOTES AND EUKARYOTES 9h

Overexpression in *E. coli*, *B. subtilis*, *Corynebacterium*, *Pseudomonas fluorescens*, yeasts like *S. cerevisiae* and *Pichia pastoris*, insect cell lines like Sf21 and Sf9, Mammalian cell line like Chinese Hamster ovary (CHO) and Human embryonic kidney (HEK), Plant single cell. Chloroplast transformation and protein expression in chloroplasts. Cell free protein Expression-Cell free extracts from *E. coli*, rabbit, insects.

Gene transfer in bacteria: conjugation, transformation, transduction.Methods for creation of transgenic animals-DNA microinjection, Embryonic stem cell-mediated gene transfer, Retrovirusmediated gene transfer. Vector mediated gene transfer.

UNIT - IV APPLICATIONS OF GENE EXPRESSION AND TRANSGENICS 9h

Use transgenic animals in medical research, in toxicology, in mammalian developmental genetics, in molecular biology in the pharmaceutical industry, in biotechnology, in aquaculture and in xenografting. Humanised animal models.

UNIT - V BIOSAFETY MEASURES

UNIT - III METHODS OF GENE TRANSFER

GMP and GLP requirements. Risk Assessment- Case study. Personal Protective Equipment: Types, Laboratory Security & Emergency Response, Use of transgenic animals. History, safety and ethics of transgenic animals- Case study.

Total: 45h

Text Books

- 1. Benjamin. A. Pierce. (2016). Genetics a conceptual approach. W.H. Freeman publishers.
- 2. Venkata R. and Prakash D. (2015). Key Notes on Genetics and Plant Breeding. Astral International publishers.

Reference Books

1. Old R.W., Primrose. S.B. (1993). Principles of gene manipulation an introduction to genetic engineering. Blackwell

Weblinks

1.https://www.genome.gov/genetics-glossary/Transgenic

CO-PO MAPPING

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	1	-	-	-	-	-	-	-	-	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	2	1	-	1	-	-	-	-	-	-	-	-	2
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	1	-	-	-	1	-	-	-	1	-	2
Avg.	2.6	1.8	1.3	1	1	-	-	1	-	-	-	1	-	2

2023-2024

152

9h

3H-3C

Semester - V

23BTBT5E06 AGRICULTURE BIOTECHNOLOGY

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

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

Course Objectives:

The goal of this course is for students to

- Know about chronology and importance of ancient Indian agriculture techniques
- Gain knowledge on basic concepts of plant nutrition, maturity indices and post-harvest losses
- Learn and apply the fundamental aspects of organic farming
- Understand concepts involved in nitrogen fixation and apply knowledge of molecular farmingfor

production of industrial important plant products.

Course Outcomes:

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

- 1. Outline the basic concepts in plant growth and physiology
- 2. Infer the problems in post-harvest losses and investigate more solution for betterment.
- 3. Relate biotic and abiotic system in plant growth and development
- 4. Summarize the importance of organic farming and role of biotechnology in development of organic farming
- 5. Illustrate the techniques in molecular farming and concepts in nitrogen fixation

UNIT-I INTRODUCTION TO AGRICULTURAL BIOTECHNOLOGY

Origin of cultivated plants and plant indication, Introduction to Indian Agriculture heritage; Soil management and its relevance in Pre-modern India. Review of plant cell structure and function; Review of water uptake; Introduction to plant nutrition; Mineral availability- uptake of minerals; Methods of breeding self-pollinated and vegetatively propagated plants; Seed Germination and Seedling Growth; Heterosis – Genetic and Molecular basis, Apomixis – Mechanism and significance in crop improvement.

UNIT-II MOLECULAR FARMING AND NITROGEN FIXATION 9h

Molecular farming for the production of industrial enzymes, biodegradable plastics, polyhydroxybutyrate, antibodies, edible vaccines; Use of mutants in crop improvement and polyploidy; Metabolic engineering of plants for the production of fatty acids, industrial oils, flavonoids etc., Engineering of carotenoid and provitamin biosynthetic pathways. Nitrogen fixation and biofertilizers – Diazotrophic microorganisms, nitrogen fixation genes; Two component regulatory mechanisms; Transfer of nif genes and nod genes – structure, function and role in nodulation.

B.Tech. Biotechnology

UNIT-III BIOTIC AND ABIOTIC STRESS BIOLOGY

Introduction to biotic stresses, types. Application of plant transformation – bt genes, Structure and function of Cry proteins – mechanism of action, critical evaluation. Non bt like protease inhibitors, alpha amylase inhibitor, Transgenic technology for development of virus, bacterial and fungal resistance plants. Concept of plasticity in plant development; Abiotic stress – Introduction to drought and salinity stresses, transgenic strategies for development of drought resistant plants, case studies.

UNIT-IV BIOTECHNOLOGY IN ORGANIC FARMING

Organic farming, principles and its scope in India; Organic ecosystem and their concepts; Role of Biotechnology in organic nutrient resources and its fortification; Restrictions to nutrient use inorganic farming; Choice of crops and varieties in organic farming; Biotechnology in fundamentals of insect, pest, disease and weed management under organic mode of production; Integrated compost production-microbe enriched compost; Important industries producing Biopesticides.

UNIT-V POST HARVEST BIOTECHNOLOGY

Importance of post harvest physiology; Stages of growth; Maturity indices; Fruit ripening- changes during ripening; Post harvest losses-types; Technologies to control post harvest losses; Respiration and transpiration loss, methods to measure respiration and transpiration losses; Spoilage of fruit and vegetable, Microbial contaminants and post-harvest pathology; Potential application of biotechnology to reduce post harvest losses; Enzymatic browning and its control.

Total : 45h

Text Books

- 1. Plant Biotechnology and Agriculture by Arie Altman Paul Hasegawa, Academic Press, 2011.
- 2. Post Harvest Technology of Fruits and vegetables (Volume 1 and 2) by L.R. Verma and V.K. Joshi, Indus Publishing Company, New Delhi. 2006.

Reference Books

- 1. Biotechnology in Agriculture, a Dialogue by MS Swamynathan, McMillian India Ltd, 1991.
- 2. Plant biotechnology in Agriculture by K. Lindsey and M.G.K. Jones, Prentice hall, New Jersey, 1989.

Weblinks

1. https://www.fda.gov/food/consumers/agricultural-biotechnology

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	1	-	-	-	-	-	-	-	1	-	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO4	2	1	-	-	-	-	1	-	-	-	-	1	-	2
CO5	2	1	-	-	1	-	-	-	-	-	-	-	1	2
Avg.	2	1	-	1	1	-	1	-	-	-	-	1	1	2

CO-PO MAPPING

9h

9h

23BTBT5E07

STEM CELL TECHNOLOGY

Semester – V 3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Explain basic knowledge on stem cells and stem cell niche.
- Illustrate the function and properties of adult and embryonic stem cells.
- Discuss the cell cycle regulations, checkpoints and its epigenetic control.
- Outline various techniques utilized for the development of stem cells.
- Explain the types of stem cells from different origin and its regeneration and experimental methods.
- Outline the usage of stem cells in different medical applications.

Course Outcomes

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

- 1. Summarize the characteristics of stem cells.
- 2. Outline the properties of adult and embryonic stem cells.
- 3. Infer the role of checkpoints in cell cycle regulation and significance of epigenetic control.
- 4. Outline the different sources of stem cells
- 5. Explain the application of stem cells in medical field.

UNIT - I INTRODUCTION TO STEM CELLS & STEM CELL NICHE 9h

Introduction to Stem Cells: Principles and properties of stem cells, types of stem cells, comparison of embryonic and adult stem cells. Scope of stem cells - definition of stem cells - concepts of stem cells - differentiation, maturation, proliferation, pluripolericy, self - maintenance and self - renewal. Stem Cell Niche: Introduction to stem cell niches in gut epithelium, bone marrow, epidermis, testis and neural tissues.

UNIT - II EMBRYONIC & ADULT STEMCELLS

In vitro fertilization - culturing of embryos-isolation of human embryonic stem cells - blastocyst - inner cell mass - growing ES cells in lab - laboratory tests to identify ES cells - stimulation ES cells for differentiation - properties of ES cells. Somatic stem cells - test for identification of adult stem cells - adult stem cell differentiation - trans differentiation - plasticity.

UNIT - III CELL CYCLE, DEVELOPMENT AND EPIGENETIC CONTROL 9h

Cell Cycle and Development: Cell cycle regulators and checkpoints, cell fusion, differentiation of stem cells and their role in self-renewal. Epigenetic Control: DNA-methylation and histone modifications, genomic imprinting, telomerase regulation, X-chromosome inactivation, reprogramming of cells, induced pluripotent stem cells and their therapeutic applications.

UNIT - IV TYPES AND REGENERATION, EXPERIMENTAL METHODS 9h

Types and regeneration: Stem cells derived from amniotic fluid, extra embryonic membrane, germ cells, hematopoietic organs, neurons and kidney, cord blood transplantation, donor selection, HLA matching, patient selection, peripheral blood and bone marrow transplantation, bone marrow and cord blood collection procedures and cryopreservation and their applications. Experimental Methods: Isolation and differentiation of human adult stem cells, embryonic stem cells and mouse stem cells, stem cell techniques: fluorescence activated cell sorting (FACS), fluorescent protein tagging.

UNIT - V POTENTIAL USES OF STEM CELLS

Cellular therapies - vaccines - gene therapy - immunotherapy - tissue engineering. Stem cells applications in cancer, diabetes, heart disease, muscular dystrophy, regeneration of epidermis; stem cell regulations-India and international, debate, social and ethical concerns, Organ farming.

Total: 45 h

Text Books

- 1. Lanza. R. P. (2013). Essentials of stem cell biology, 3rd edition. Academic Press.
- 2. Kursad and Turksen. (2012). Adult and Embryonic Stem cells, 2nd edition. Humana Press.

Reference Books

- Treleaven J. (2009). Hematopoietic Stem Cell Transplantation. 1st Edition. Elsevier Health -UK.
- 2. Lodish et al. (2008). Molecular Cell Biology. 6th Edition. W.H. Freeman & Co.
- 3. Ariff Bongso and Eng Hin Lee. (2005). Stem Cells: From Bench to Bedside. World ScientificPulishing Co Pte Ltd.

Weblinks

1. https://medlineplus.gov/stemcells.html

CO-PO MAPPING

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO5	2	1	-	-	1	-	-	-	-	-	-	-	-	2
Avg.	2	1	-	-	1	-	-	-	-	-	-	_	1	2

Semester-V

3H-3C

23BTBT5E08 BASIC PHARMACOLOGY AND TOXICOLOGY

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

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

Course Objectives

The goal of this course is for students to

- Outline the basic on pharmacology and. biotechnology.
- Illustrate the function and properties of drug and pharmacokinetics.
- Discuss the drug action and reaction
- Summarizes the basic on toxicology
- Discuss types of toxicology and its effect on different organ systems
- Outline the application of toxicology in pharmacology for different medical applications.

Course Outcomes

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

- 1. Summarize the basic on pharmacology
- 2. Outline pharmacokinetics and pharmacodynamics
- 3. Infer the drug action and reaction affect drug entering into a system.
- 4. Summarize basic concepts of toxicology
- 5. Illustrate the relationship between pharmacovigilance and pharmodyamics

UNIT-I GENERAL PHARMACOLOGY

Introduction to pharmacology, branches and scope of the subject of pharmacology, Nature and sources of Drugs, Drug nomenclature and dosage forms, Routes of drugs' administration; advantages and disadvantages of different routes, Biotechnology in pharmacology- Drug discovery.

UNIT-II PHARMACOKINETICS AND PHARMACODYNAMICS

Pharrmacokinetic considerations: absorption, distribution, biotransformations and drug excretion; Pharmacokinetic concepts of bioavailability, apparent volume of distribution (aVd), half life (t¹/₂), and clearance (CL). Pharmacodynamics; site and mechanism of drug action, drug receptors and receptor regulation, concepts of agonists, antagonists, partial agonist and inverse agonist drugs

UNIT-III DRUG ACTION AND REACTION

Quantitative aspect of drug action: analysis of dose response curve and therapeutic index (safety index); Factors affecting drug action and doses, Adverse drug reactions (ADRs) and role of pharmacovigilance activity in ADR monitoring; Clinical Pharmacology, Scope and relevance of Clinical Pharmacology

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9h

9h

B.Tech. Biotechnology

UNIT- IV GENERAL CONCEPTS IN TOXICOLOGY

Basic principles of toxicology and biochemical mechanism of toxicity in mammalian species and man, Classes of toxicants, introduction to toxicogenomics, disposition of toxicants. Introduction to Pharmacogenomics and pharmacogenetics

UNIT- V SYSTEMIC TOXICOLOGY AND HEALTH SAFETY

Toxicity in organ systems (Hepatotoxicity, nephrotoxicity, nervous system, endocrine system, respiratory system, reproductive system, and blood as a target organ), correlation between morphological and functional changes caused by toxicants and environmental pollutants in different organs. Toxicological evaluation of a new drug. Post market surveillance of drugs and OTC herbal supplements.

Total: 45 h

Text Books

1. The Pharmacological Basis of Therapeutics by Goodman & Gilman

2. Casarett & Doull's Essentials of Toxicology, edited by CD Klassen and JB Watkins

Reference Books

1. Biopharmaceutics and Pharmacokinetics: An Introduction by Notari, R. E.

2. Basic and Clinical Pharmacology by Katzung

Weblinks

1. https://karger.com/cth/article-abstract/11/3-4/142/88774/Basic-Problems-of-Clinical-Pharmacologyand?redirectedFrom=PDF

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	1	2	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO5	2	1	-	-	-	-	-	-	-	-	-	1	-	2
Avg.	2	1	-	-	-	-	-	-	-	-	-	1	1.3	2

CO-PO MAPPING

158

2023-2024

9h

Professional Elective – IV

Semester -VI

23BTBT6E01

STRUCTURAL BIOLOGY

Semester-VI 3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Focus on relating theoretical concepts and experimental approaches to a wide range of potential research problems in the area of structural biology.
- The course aims to provide a solid foundation and breadth of understanding in structural biology that will facilitate application to current and future research problems.
- Understanding of the basic science of Protein Structure, including first principles of the physical interactions that maintain proteins and the mechanisms
- Learn about different techniques and experimental approaches that represent the state-of-the-art and are widely used in the study of proteins.
- Understand the current concepts in structural biology and biochemistry.

Course Outcomes

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

- 1. Outline the structure and function properties of biological macromolecules.
- 2. Summarize the alternative scientific approaches on specific structural biology questions.
- 3. Illustrate the basic in elementary crystallography
- 4. Explain basic in X-ray scattering.
- 5. Summarize the principles involve in NMR.

UNIT I - FUNDAMENTALS OF PROTEIN STRUCTURE

9h

Fundamentals of protein structure- amino acids fundamental building blocks,

Peptide bond, rigid planar peptide unit, *cis* and *trans* configuration. Structural Hierarchy: Primary, Secondary, Tertiary, Quaternary structures. Motifs and domains: α - domain structures, β – domain structure α/β (alpha/beta) - structures. Principles of nucleic acid structure: Chemical structure of nucleic acids, Watson and Crick's base-pairings and their implications. Non Watson and Crick pairing schemes - base stacking interactions - DNA polymorphism - structure of ADNA, BDNA and ZDNA - helical transitions. Conformation of protein (Ramachandran plot, Secondary structure), Protein folding

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UNIT II - PROTEIN CRYSTALLIZATION

Protein Crystallization: Principles of protein crystallization, Preparation of crystal for Xray experiment. Crystallization techniques: Batch method, liquid-liquid diffusion method, vapour diffusion method- hanging drop, sitting drop, dialysis. Seeding Methodmacroseeding, microseeding, other seeding methods, Thermodynamics and kinetics of protein crystallization, structural genomics project

UNIT III - ELEMENTARY CRYSTALLOGRAPHY

Introduction: symmetry in crystals, lattices and unit cells, crystal systems, Bravais lattices, Elements of symmetry - rotation axis, mirror planes and center of inversion, proper/improper axes of rotation, translational symmetry- screw axis and glide planes. Symmetry operation: classes of smmetry operations, classification of symmetry point groups and molecular space groups and equivalent points. X-ray diffraction - Laue equations - Bragg's law - reciprocal latticeand its application to geometrical Crystallography. Structural determination of macromolecules by crystallography technique.

UNIT IV - X-RAY SCATTERING

X-ray scattering: Atomic scattering factor - diffraction by a space lattice - structure factorequation - electron density and Fourier series - Fourier Transform and crystal diffraction - Phase Problem – Direct methods, molecular replacement method, Patterson function, heavy atom method.

UNIT V - NUCLEAR MAGNETIC RESONANCE

Nuclear Magnetic Resonance:- Introduction, Nuclear spin, NMR sensitivity, shielding and deshielding effects of NMR, nuclear Over hauser effect. Spectral parameters: chemical shift, spin-spin splitting, coupling, non-equivalent proton. Carbon-13 NMR spectra of protein, FTNMR, spin-spin splitting, proton spin decoupling, off-resonance decoupling, Spin-latticerelaxation time. Multidimensional NMR, COSY, NOSEY, MRI, ESR. Application of NMR to biology-Regulation of DNA transcription, Protein-DNA interaction. Case study on Protein Engineering.

Text Books

- 1. C. Branden and J. Tooze. (1998). Introduction to protein structure. Garland Science. 2^{nd} edition
- George H. Stout, Lyle H. Jensen. (1989). X-Ray Structure Determination: A PracticalGuide. Wiley-Interscience. 2nd Edition.

Reference Books

- 1. Philip E. Bourne, Helge Weissig. (2003). Structural Bioinformatics. Wiley Publication.
- 2. McPherson. (1999). Crystallization of Biological Macromolecules. Cold Spring HarborLaboratory Press.
- 3. Schulz, Georg E., and R. Heiner Schirmer. (2013). Principles of protein structure. 1st Edition re-print, Springer Science & Business Media

9h

9h

9h

9h

Total: 45h

2023-2024

Websites

- 1. https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/spectrpy/nmr/nmr1.htm
- 2. https://www.news-medical.net/life-sciences/What-is-X-ray-Crystallography.aspx

CO-PO MAPPING

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	-	-	-	-	-	-	-	-	-	-	-	1	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	1	-	-	-	-	-	-	-	1	2
CO4	2	1	-	-	1	-	-	-	-	-	-	-	-	2
CO5	2	1	-	-	1	-	-	-	-	-	-	-	1	2
Avg.	2	1	1	-	1	-	-	-	-	-	-	-	1	2

23BTBT6E02

GENOME EDITING

Semester – VI 3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Understand the basics of genome editing.
- Describe the traditional methods of gene editing.
- Examine the current genome editing technologies.
- Outline the mechanism behind the development of GMO's.
- Gain knowledge on the application of modern tools for precision gene targeting and editing.
- Illustrate the Principles and modern approaches for the use of CRISPR-Cas genome engineering technologies

Course Outcomes

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

- 1. Explain the features of various genome editing technologies.
- 2. Outline the technological background behind genome editing.
- 3. Summarize the vast applications of gene editing in the field of medicine, agriculture, and the environment.
- 4. Identify the ethical issues in genome editing.
- 5. Analyze the potential recent innovations in genome editing.

UNIT - I INTRODUCTION

Basics of Recombinant DNA Technology - Restriction and modifying enzymes, vectors – plasmids , bacteriophage and other viral vectors, cosmid, Ti plasmids, Bacterial and yeast artificial chromosomes, Expression vector, construction of recombinant DNA molecules, transformation of r-DNA molecules into target host organisms; Calcium chloride mediated-electroporation- microinjection- gene gun, selection methods for recombinants; antibiotic resistance - blue & white selection, GFP and Luciferase based selection.

UNIT - II OVERVIEW OF TRADITIONAL METHODS 9h

Homologues recombination for gene knockout. RNAi system, Transgenic and site specific recombination: Cre-LoxP, Phi31 integrase and Flp-FRT systems.

UNIT - III ENGINEERED ENZYME SYSTEMS

Zinc finger nucleases (ZFNs), transcription-activator like effector nucleases (TALEN), meganucleases and the clustered regularly interspaced short palindromic repeats (CRISPR/Cas9) system. Design of sgRNA. Multiplex Automated Genomic Engineering (MAGE).

UNIT - IV APPLICATIONS OF GENOME EDITING

Application of genetically modified organisms; Molecular Diagnosis of human genetic diseases, pathogenic virus and bacteria, agriculture – Transgenic Bt cotton- round-up ready soybean transgenic crops, Biosafety levels for microbial, plant and animals, safety guidelines and release procedure for GMOs in India, effect of GMOs on environment, patenting of gene sequences and its issues.

UNIT - V CASE STUDIES

Recent innovations in the technology and case studies where current genome editing technologies has been used for various purposes like health, agriculture and environment.

Total : 45 h

Text Books

- Yonglun Luo. (2019). CRISPR Gene Editing, Methods and Protocols. 1st Edition. HumanaPress.
- 2. Krishnarao A. (2018). Genome Editing and Engineering, From TALENs, ZFNs and CRISPRsto Molecular Surgery. Cambridge University Press.

Reference Books

- 1. Stephen H. Tsang. (2017). Precision Medicine, CRISPR, and Genome Engineering Movingfrom Association to Biology and Therapeutics. 1st Edition. Springer.
- 2. Brown. T.A. (2006). Genomes 2. 3rd Edition. Bios Scientific Publishers Ltd, Oxford.
- 3. Glick. B. R. & Pasternick. J. J. (2003). Molecular Biotechnology: Principles and Applicationsof Recombinant DNA. 3rd Edition, ASM press, Eashington.

Weblinks

1. https://www.who.int/health-topics/human-genome-editing#tab=tab_1

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	1	-	-	-	-	-	-	-	-	2
CO2	2	1	-	-	1	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	2	1	-	1	-	-	1	-	-	-	-	-	2
CO5	3	2	1	-	1	-	-	-	-	-	-	-	-	2
Avg.	2.4	1.4	1	-	1	1	-	1	-	-	-	-	-	2

CO-PO MAPPING

9h

9h

23BTBT6E03

BIOINPUTS FOR AGRICULTURE

Semester-VI 3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Understand the basics of biofertilizers.
- Describe the biostimulants and their applications.
- Examine the current pest control strategies.
- Outline the mechanism of fungi in soil.
- Gain knowledge on the application of modern tools for fungal biofertilizers
- Illustrate the Principles and modern approaches for the use of liquid fertilizers

Course Outcomes

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

- 1. Outline the basic in bio inputs and biofertilizers.
- 2. Summarize about the bio stimulates applied for plants.
- 3. Illustrate various form of biopesticides and its advantages.
- 4. Infer the fungal based biofertilizers.
- 5. Illustrate recent trends in liquid biofertilizers.

UNIT I- BIOINPUTS & Biofertilizers

Bioinputs: Definition and types. status scope and importance, Classification of Bioinputs, Importance of biofertilizers in agriculture, type of biofertilizers and its scope - Strain selection - Inoculum preparation - Mass production. Plant-microbe interaction - Soil ecosystem. Algal Biofertilizers, Bacterial biofertilizers, Mycorrhizal fungi as biofertilizers

UNIT II- Bio stimulant

Bio stimulant- Definition. Properties of Bio -stimulants, Types- Humic, seaweed and hydrolysates, Mode of working of bio stimulants on plants, Application of bio stimulants, Case study -Biostimulant

UNIT III – Biopesticides

Insecticides, Bio pesticides, Types of biopesticides, Mode of action of biopesticides, Genetic engineering in bio pesticides, Case study on biopesticides.

UNIT IV- FUNGAL BIOFERTILIZER

Mycorrhizal fungi as biofertilizers – Importance of Ecto, Endo and Arbuscular mycorrhizae (AM). Methods of collection and inoculum production – Application - Techniques of Ectomycorrhizal inoculums, Endo mycorrohizae of orchids.

9h

9h

9h

9h

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9h

UNIT V- LIQUID BIOFERTILIZER

Liquid biofertilizers - Formulation – Advantages - Application methodology. Role of liquid biofertilizer in tissue culture. Biofertilizers - Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers. National and Regional biofertilizer production and development Centers.

Total: 45 h

Text Books

- 1. Dubey, R. C., "A Textbook of Biotechnology", S. Chand & Co., New Delhi.
- 2. Newton, W. E. et al. "Recent Developments in Nitrogen Fixation", Academic Press, New York.

3. Schwintzer, C. R. and Tjepkema, J. D., "The Biology of Frankia and Actinorhizal Plants",

Academic Press Inc., San Diego, USA.

Reference Books

- 1. Subba Rao, N. S., "Soil Microbiology", 4th ed. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- 2. Yadav,A.K., Motsara M.R and RaychaudhuriS., "Recent Advances in Biofertilizer Technology" SPURT publication, New Delhi, 2001.

Weblinks

1. <u>https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2017/02/understanding-biological-farming-inputs</u>

2. https://www.jaivikkheti.in/DMS/Production%20Technology%20of%20Organic%20Inputs.pdf

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	1	1	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	2
CO5	2	1	-	-	-	-	-	-	-	-	-	-	1	2
Avg.	2	1	-	-	-	-	-	-	-	-	-	1	1	2

CO-PO MAPPING

Semester-VI

3H-3C

23BTBT6E04 FERMENTATION TECHNOLOGY

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

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

Course Objectives

The goal of this course is for students to

- Recognize the overall industrial fermentation process and the process flow sheet.
- Understand the knowledge on medium optimization and sterilization techniques.
- Interpret the knowledge on production of commercially important primary metabolites & secondary metabolites.
- Understand the selection and design of fermenter

Course Outcomes

Upon completion of this course the student will be able to

- 1. Recall the basics of industrial fermentation and other processes.
- 2. Outline on medium optimization and sterilization techniques.
- 3. Explain the importance of fermentation in the production of secondary metabolites
- 4. Summarize the criteria for selection and design of fermenter.
- 5. Apply the knowledge of fermentation on process economics

UNIT I INTRODUCTION TO FERMENTATION

History and development of fermentation industry; General requirements of fermentation processes; types of fermentation – homo fermentation, hetero fermentation: category of fermentation based on end product formed – lactic acid fermentation, alcohol fermentation, acetic acid fermentation, butyric acid fermentation.

UNIT II Medium Optimization and Sterilization

Medium requirements for fermentation processes, Carbon, Nitrogen, Minerals, Vitamins and Other Complex nutrients, Oxygen requirement. Medium optimization-Methods of media optimization (One factor method and Plackett- Burman design). Types of sterilization techniques; Thermal death kinetics of microorganisms, Batch and Continuous sterilization of liquid media, Filter sterilization, Design of sterilization equipment.

UNIT III ADVANCES IN FERMENTATION TECHNOLOGY

Microbial fungicides and Pesticides, Chemicals and Pharmaceuticals made by fermentation, Fermented food products - Beer, Wine, Genetically Modified Organisms, Biopolymers. Microbial leaching, Effluent treatment using microbes, Future of fermentation technology and its products.

UNIT IV DESIGN OF FERMENTER

Key components of fermenter, Types of fermenters- batch, CSTR, Fed batch; Design of fermenter body, selection of impeller, baffles, Types of spargers; Types of sealing. Selection criteria of fermenter, Softwares for fermenter design and simulation.

UNIT V FERMENTATION PROCESS ECONOMICS

Process economics: General fermentation process economics; materials usage and cost; capital investment estimate; production cost estimate. Case studies -Traditional product and recombinant product; Bioprocess validation: Introduction, why validation, when does validation occur, validation

9h

9h

9h

9h

9h

165

structure, resources for validation, validation of systems and processes including SIP and CIP.

Total: 45h

Text Books

1. Peter F Stanbury, Allan Whitaker, Stephen J Hall. Principles of Fermentation Technology. (2016)Butterworth-Heinemann Press. UK.

2. H. J. Peppler, D. Perlman. Microbial Technology: Fermentation Technology. (2014). AcademicPress.

Reference Books

- 1. T. El-Mansi, C. Bryce, Arnold L. Demain, A.R. Allman. Fermentation Microbiology and Biotechnology. Second Edition. (2006). CRC Press, USA.
- 2. Pandey A, Lasroche C, Soccol C. R and Dussop C. G. Advances in Fermentation technology (2008). Asiatech publishers Inc.

Weblinks

- 1. https://microbenotes.com/fermentation/
- 2. https://www.cambridge.org/core/books/abs/biotechnology/bioprocessfermentation-technology

CO-PO MAPPING

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	2
Avg.	2.2	1.2	1	-	-	-	-	-	-	-	-	-	1	2

Professional Elective – V

Semester - VII

23BTBT7E01 BIOPROCESS ECONOMICS AND PLANT DESIGN 3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Understand the basic economics involve in cost analysis.
- Summarizes the key consideration required for bioprocess economics.
- Outline the process design involve in plant design and selection of instruments.
- Understand various strategies of basic considerations in equipment design
- Apply knowledge to solve various design-based problems.

Course Outcomes:

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

- **1.** Outline the basics of economic evaluation for a bioprocess.
- 2. Summarize Bioprocess Economics and its importance.
- 3. Illustrate the various strategies of process design
- 4. Infer various strategies of basic considerations in equipment design
- 5. Apply knowledge to solve various design-based problems.

UNIT I ECONOMIC EVALUATION

Capital cost of a project; Interest calculations, nominal and effective interest rates. Basic concepts in tax and depreciation; Measures of economic performance, rate of return, payout time. Cash flow diagrams; Cost accounting-balance sheet and profit loss account. Break even and minimum cost analysis.

UNIT II BIOPROCESS ECONOMICS

Introduction, elements of total production cost, outline of the total capital investment, equipment sizing, capital cost estimates large-scale equipment and utilities. Manufacturing cost estimates – Operating costs-Raw materials, utilities, fixed costs and overhead costs, case studies of antibiotics, recombinant products, single cell protein.

UNIT III INTRODUCTION TO PROCESS DESIGN

Schematic representation of unit operations, design information and flow diagrams, material and energy balances, formulation of the design problem, the Hierarchy of chemical process design and integration, optimization, Health and safety Hazards, Environment protection, plant location and lay out.



9h

UNIT IV BASIC CONSIDERATIONS IN EQUIPMENT DESIGN

General design procedure, equipment classification, materials of construction - Mechanical properties - strength, elasticity, ductility, resilience, toughness, hardness, creep, fatigue. Metals- ferrous metals, types of iron & steels, nonferrous metals and Non-metals. Corrosion: Forms of corrosion and their presentation, Choice of materials.

UNIT V BASIC DESIGN PROBLEMS

Design examples on continuous fermentation, aeration and agitation. Design calculation of filter for air sterilization; Design of batch and continuous sterilizers. Design calculations for immobilized enzyme kinetics; Practical considerations in designing of Bioreactor/Fermentor construction. Design consideration of valves, pumps, steam traps, spargers and impellers used in fermentation industries. Problems associated with design equations.

Total: 45 h

Text Book

1. Peters & Timmerhaus, Plant design and Economics for Chemical Engineers McGraw Hill Higher

Education (2004).

Reference Books

- 1. M V Joshi & V .V. Mahajani, Process equipment design, 3rd Ed. Macmillan India Limited (2000)
- 2. Harvey W Blanch, Biochemical Engineering, 2ndEd, Taylor & Francis. 2009

Weblinks

1. https://www.cheric.org/files/education/cyberlecture/d200301/d200301-1801.pdf

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	1	-	-	-	-	-	-	-	-	-	1	2
Avg.	2.2	1.2	1	-	-	-	-	-	-	-	-	-	1	2

CO-PO MAPPING

9h
23BTBT7E02

TISSUE ENGINEERING

Semester - VII 3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Explain the different cell types and their advances in tissue engineering.
- Discuss the various biomaterials for tissue engineering.
- Outline the basic concepts of tissue engineering and tissue creation.
- Discuss the principles and practice of gene therapy.
- To identify and organize differing views on advances on tissue engineering.
- To utilize the process for the identification and development of a clinically relevant strategy to restore, repair or regeneration of a dysfunctional tissue or organ.

Course Outcomes

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

- 1. Outline the basic concepts in tissue engineering
- 2. Summarize different biomaterials for tissue engineering
- 3. Explain the components of the tissue architecture
- 4. Illustrate the principles of gene therapy
- 5. Summarize the concepts of tissue engineering in different fields.

UNIT - I BIOLOGICAL STUDY OF DIFFERENT CELL TYPES 9h

Cell line, Establishment of cell lines, Different cell types: Endothelial cell, Fibroblast cells, Epithelialcell, Myoblast cells, chromaffin cell, Smooth muscle cells & plasma cell.

UNIT - II BIOMATERIALS FOR TISSUE ENGINEERING

Biomaterials: Degradable polymeric scaffolds, Acellular Bio-Matrices, In-vitro and In-vivo evaluation of biomaterials ,Biological derived polymers in tissue engineering Cell seeding of scaffolds. Bioreactors used in tissue engineering . Role of Nanotechnology

considerations of gene therapy.

migration in tissue engineering.

UNIT III TISSUE ARCHITECTURE

UNIT - V ADVANCES IN TISSUE ENGINEERING

UNIT - IV PRINCIPLES AND PRACTICE OF GENE THERAPY

Development of artificial tissues; Transplantation biology: Tissue typing, Techniques of tissue typing, Minor histocompatibility antigens, Immuno-suppression, Side effects of immuno-suppression. Organ regeneration. 3D bio printing for tissue engineering

Tissue types and Tissue components, Tissue repair, Engineering wound healing and sequence of events. Basic wound healing Applications of growth factors: VEGF/angiogenesis, Basic properties, Cell-Matrix& Cell-Cell Interactions, telomeres and Self-renewal, Control of cell

Introduction to gene therapy, Requirements of gene therapy, Genetic defects, Target cells for gene therapy, process of gene therapy, Factors responsible for gene therapy for makingeffective

Text Books

- 1. Ranga. M. M. (2010). Animal Biotechnology. Agrobios.
- 2. Robert Lanza, Robert Langer, Joseph Vacanti. (2014). Principles of Tissue Engineering. 4thEdition. Academic Press. eBook ISBN: 9780123983701.

Reference Books

- John P. Fisher, Antonios G. Mikos, Joseph D. Bronzino, Donald R. Peterson. (2013). Tissue Engineering: Principles and Practices. 1st Edition. CRC Press. ISBN 9781138077867 -CAT# K34349.
- 2. Bikramjit Basu, Sourabh Ghosh. (2016). Biomaterials for Musculoskeletal Regeneration-Applications. Springer. ISBN 978-981-10-3017-8.
- 3. Lanza R, Langer R, Vacanti JP, Atala A, editors.(2020) Principles of tissue engineering. Academic press.

Weblinks

1. https://www.frontiersin.org/articles/10.3389/fbioe.2017.00040/full

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	1	1	2
CO2	2	1	-	-	1	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	1	-	-	-	-	-	-	-	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO5	2	1	-	-	1	-	-	-	-	-	-	1	-	2
Avg.	2	1	-	-	1	-	-	-	-	-	-	1	1	2

CO-PO MAPPING

170

9h

Semester - VII

23BTBT7E03 MOLECULAR MODELING AND DRUG DESIGN 3H-3C

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

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

9h

9h

Course Objectives

The goal of this course is for students to

- Explain the basic concepts of molecular modelling.
- Outline the computational quantum mechanics through different methods.
- Discuss the general features of molecular mechanics.
- Perform the molecular dynamics simulation methods.
- Outline the concept on cheminformatics molecular modeling.
- Explain the structure-based drug design for all classes of targets.

Course Outcomes

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

- 1. Outline basic concepts on molecular modeling.
- 2. Summarize various calculations on molecular properties.
- 3. Illustrate the concept behind molecular mechanics through derivative methods.
- 4. Identify the molecules simulation through dynamics methods.
- 5. Apply the diverse techniques on molecular modeling.

UNIT - I MOLECULAR MODELLING

Introduction to concept of molecular modeling, molecular structure and internal energy, applications of molecular graphics, coordinate systems, potential energy surfaces, discussion of local and global energy minima. Bond Stretching – Angle Bending – Torsional terms — Electrostatic interactions – Van Der Waals interactions – Effective pair Potentials – Hydrogen Bonding – Simulation of liquid water.

UNIT - II QUANTUM MECHANICS

Introduction to the computational quantum mechanics; one electron atom, ply electronic atoms and molecules, Hartree Fock equations; calculating molecular properties using ab initio and semi empiricalmethods.

UNIT - III MOLECULAR MECHANICS

Molecular mechanics; general features of molecular mechanics force field, bond stretching, angle bending, torsional terms, non-bonded interactions; force field parameterization and transferability; effective pair potential, energy minimization; derivative and non-derivative methods, applications of energy minimization.

UNIT - IV MOLECULAR DYNAMCS

Molecular dynamics simulation methods; molecular dynamics using simple models, molecular dynamics with continuous potential, setting up and running a molecular dynamic simulation, constraint dynamics; Monte Carlo simulation; Monte Carlo simulation of molecules. Molecular Dynamics using simple modules— Constant dynamics – Time dependent properties – Molecular Dynamics at constant temperature and pressure.

UNT - V MODELLING AND DRUG DESIGN

Introduction to cheminformatics, Macromolecular modeling, design of ligands for known macromolecular target sites, Drug- receptor interaction, classical SAR /QSAR studies and their implications to the 3 D modeler, 2-D and 3-D database searching, pharmacophore identification and novel drug design, molecular docking, Structure-based drug design for all classes of targets. Deriving and using 3D Pharma cores – Structure Based methods to identify lead components- De novo ligand design.

Text Books

B.Tech. Biotechnology

- 1. Leach. A. (2001). Molecular modeling: Principles and application. Prentice Hall.
- 2. Yvonne, Martin. C. and Willett. P. (1998). Designing bioactive molecules: three dimensionaltechniques and applications. Washington, DC. American chemical society.

Reference Books

- 1. Schlecht. M. F. (1998). Molecular modeling on the PC. Wiley Blakwell; Har.
- 2. Andrew R. Leach. (2001), "Molecular Modeling: Principles and applications ", prentice hall publications.

Weblinks

1. https://www.schrodinger.com/intro-to-molec-model-course-page

2023-2024

9h

9h

9h

Total : 45h

CO-PO MAPPING

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	1	-	-	-	-	-	-	-	-	2
CO4	3	2	1	-	1	1	-	-	-	-	-	-	-	2
CO5	3	2	1	-	1	1	-	-	-	-	-	-	-	2
Avg.	2.4	1.4	1	-	1	1	-	-	-	-	-	-	1	2

23BTBT7E04

CLINICAL TRIAL AND MANAGEMENT

Semester - VII 3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Explain the types and scope of clinical research.
- Illustrate the various ethical theories and foundations of clinical trials.
- Discuss the evolution and regulation of clinical research.
- Outline the various designing protocols and amendments of clinical research.
- Summarize the different biostatistics and data management.

Course Outcomes

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

- 1. Summarize the scope of clinal research and design of clinical trials.
- 2. Outline the ethical theories of clinical research.
- 3. Illustrate the history and regulation of clinical research.
- 4. Identify the basic views in different situations of biostatistics in clinical trials.
- 5. Apply the perspective techniques and create data on different clinal research.

UNIT - I INTRODUCTION TO CLINICAL RESEARCH

Definition, Types and Scope of Clinical Research, Good Clinical Practices - Introduction to study designs and clinical trials - Careers in Clinical Research.

UNIT - II ETHICS IN CLINICAL RESEARCH

Ethical Theories and Foundations, Ethics Review Committee, Ethics and Historically derived principles -Nuremberg Code, Declaration of Helsinki, Belmont Report, Equipoise, Informed consent, Integrity & Misconduct.

UNIT - III REGULATIONS IN CLINICAL RESEARCH

Drug development and trial Planning-Evolution and History of Regulations in Clinical Research, Patents US Regulatory Structure, IND, NDA, ANDA, Post Drug Approval Activities, PMS, FDA Audits and Inspections EU Regulatory Affairs, EMEA Organization and Function, INDIAN Regulatory system, Schedule Y- Rules and Regulations, Description of trial phases, Trial contexts and examples

9h Intr

9h

UNIT - IV CLINICAL RESEARCH METHODOLOGY AND MANAGEMENT 9h

Designing of Protocol, Study/ Trial Design- Phase I designs - Dose-finding designs. Phase II designs - Pilot studies, Single arm, Historical control designs. Phase III designs - Factorial designs, Crossover designs, Multicenter studies, Pilot studies. Phase IV designs- Preparation of a successful clinical study, Study management, Project management Documentation, Monitoring, Audits and Inspections, Pharmacovigilance training in clinical research budgeting in clinical research.

UNIT - V BIOSTATISTICS AND DATA MANAGEMENT

Introduction to Power and Sample Size- Hypothesis testing, P-values, confidence intervals, analysis and reporting stage Data management - Data collection, Paper or electronic, Parsimony, Data validationData Monitoring, Trial Conduct - Data quality assurance, Data delinquency.

Text Books

- 1. Piantadosi.S.(2017). Clinical Trials: A Methodologic Perspective. John Wiley and sons.
- 2. Friedman. M., Furberg.C and Demets D.L. (2015). Fundamentals of clinical trials. Springer.

Reference Books

 Machin. D and Fayers. P(2010).Randomized Clinical Trials:Design Practice and Reporting. Wiley-BlackwellJ

Weblinks

- 1. https://www.niaid.nih.gov/research/dmid-clinical-research-selected-references.
- 2. https://www.globalresearchonline.net/volume1issue2/Article%20019.pdf
- 3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3272827/.

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO2	2	1	-	-	-	-	-	1	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	2	1	-	-	-	-	1	-	-	-	-	-	2
CO5	3	2	1	-	-	-	-	1	-	-	-	-	1	2
Avg.	2.4	1.4	1	-	-	-	-	1	-	-	-	-	1	2

CO-PO MAPPING

Professional Elective – VI

Semester - VII

23BTBT7E05METABOLIC ENGINEERING3H-3C

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

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

Course Objectives

The goal of this course is for students to

- Understand the basics of metabolic reactions
- Know about the biosynthesis and functions of primary metabolites
- Know about the biosynthesis and functions of secondary metabolites
- Understand the enzyme kinetics and regulations in metabolism
- Know about the metabolic pathways of various metabolites
- Understand the flux associated with metabolism

Course Outcomes

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

- 1. Outline the basics of metabolic networks in single cells and at the organ level.
- 2. Summarize the process to use organisms for the production of valuable substances on an industrial scale.
- 3. Infer stoichiometry and energetics of metabolism.
- 4. Extend to integrate modern biology with engineering principles.
- 5. Illustrate the basics on metabolic flux design

UNIT I: BASICS OF METABOLIC REGULATION

Basic concepts of Metabolic Engineering – Overview of cellular metabolism – Different models for cellular reactions, induction – Jacob Monod model and its regulation, feedback regulation, regulation in branched pathways, differential regulation by isoenzymes, concerted feedback regulation, cumulative feedback regulation, amino acid regulation of RNA synthesis, permeability control - passive diffusion, facilitated diffusion, active transport, group transportation.

UNIT II: METABOLIC ENGIREENING OF PRIMARY METABOLITES 9h

Alteration of feedback regulation for enhanced production of primary metabolites: glutamic acid. Mutants which do not produce feedback inhibitors or repressors-auxotrophs-lysine, isoleucine, arginine, purine nucleotides. Mutants that do not recognize inhibitors and repressors-resistant mutants-production ofbiotin, threonine, methionine

B.Tech. Biotechnology

UNIT III: METABOLIC ENGINEERING OF SECONDARY METABOLITES

Producers of secondary metabolites, Precursor effects, prophophase- idiophase relationship, applications of secondary metabolites, metabolic pathways and regulation for production of antibiotics (penicillin, cephalosporin, erythromycin, streptomycin),vitamins(Vit B₁₂,Vit B₂)

UNIT IV :REGULATION OF ENZYME ACTIVITY

Overview of enzyme kinetics-simple, reversible inhibition system, irreversible inhibition, un competitive, non-competitive inhibition, allosteric regulation, co-operativity-regulation of enzyme concentration- transcription initiation, translation, regulation at whole cell level.

UNIT V:METABOLIC FLUX

Integration of anabolism and catabolism, metabolic flux distribution analysis in bioprocess, material balance, kinetic types, equilibrium reaction. Experimental determination method of flux distribution, Metabolic flux analysis and its applications amino acid production by glutamic acid bacterium.

Text Books

- 1. Peter F.Stanbury, Stephen J.Hall & A.Whitaker,Principles of Fermentation technology, Butterworth-Heinemann, An imprint of Elsevier India PVT ltd.,2nd Edition,2005.
- 2. G.Stephanopoulos, , Sang Yup Lee, Jens Hoiris Nielson, Metabolic engineering concepts and applications:vol-13a, 2021.

Reference Books

1. Hiroshi shimizu, Takashi Hirasawa Volker F. Wendish, Amino acid biosynthesis- pathways, regulationand metabolic engineering, Springer-Verlag Berlin Heidelberg, 2009.

Weblinks

1. https://onlinecourses.nptel.ac.in/noc23_bt06/preview

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO5	2	1	-	-	1	-	-	-	-	-	-	-	-	2
Avg.	2	1	-	-	1	-	-	-	-	-	-	-	-	2

CO-PO MAPPING

9h

9h

Semester - VII

CANCER BIOLOGY

3H-3C

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

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

Course Objectives

23BTBT7E06

The goal of this course is for students to

- Understand the basics of normal cell structure and cancer cells
- Know about the mechanisms involved in carcinogenesis
- Unravel the concepts of oncogenes and proteins associated with them
- Understand the steps involved in cancer metastasis
- Know about the concepts of cell cycle regulation
- Design and develop novel drugs for cancer

Course Outcomes

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

- 1. Summarize the basics in cancer biology
- 2. Outline the principles of carcinogenesis
- 3. Explain the molecular mechanism of cancer biology
- 4. Infer the cancer metastasis of cancer
- 5. Demonstrate various treatment strategies of cancer.

UNIT 1: FUNDAMENTALS OF CANCER BIOLOGY

Epidemiology of cancer: environmental factors: tobacco, alcohol, diet, occupational exposure, hormones. Regulation of cell cycle, modulation of cell cycle in cancer. Different forms of cancers. Specific type of cancer hepato cellular, melanoma, breast, lung cancer. Genetic basis of cancer- DNA repair. mutations that cause changes in signal molecules, signal switches.

UNIT II: PRINCIPLES OF CARCINOGENESIS

Theory of carcinogenesis, Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, xray radiation-mechanisms of radiation carcinogenesis.

UNIT III: PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER 9h

Signal targets and cancer, activation of kinases; tumor suppressor genes, Oncogenes, identification of oncogenes, Virus and cancers: DNA virus-retroviruses detection of oncogenes. Oncogenes/proto oncogene activity. Growth factors related to transformation. Telomerases.

9h

B.Tech. Biotechnology

UNIT IV: PRINCIPLES OF CANCER METASTASIS

membrane disruption, three step theory of invasion, proteinases and tumour cell invasion.

UNIT V: CANCER THERAPY

Cancer screening and early detection, Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer. Advances in cancer detection. Different forms of therapy, chemotherapy, radiation therapy, immunotherapy, molecular therapy, use of signal targets towardstherapy of cancer; Gene therapy.

Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement

Text Books

- 1. Maly B.W.J, "Virology A Practical Approach", IRLl Press, Oxford, 1987.
- 2. Ian F.Tannock "The Basic Science of Oncology" 2nd edition, 1992, Richard P.Hill

Reference Books

- 1. Dunmock N.J and Primrose S.B., "Introduction To Modern Virology", Blackwell Scientific Publications, Oxford, 1988.
- 2. "An Introduciton Top Cellular and Molecular Biology of Cancer", Oxford Medical Publications, 1991.

Weblinks

1. https://www.cancer.gov/research/areas/biology

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CO2	2	1	-	-	-	-	-	-	-	-	-	1	2	1
CO3	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CO5	2	1	-	-	-	-	-	-	-	-	-	1	2	1
Avg.	2	1	-	-	-	-	-	-	-	-	-	1	2	1

CO-PO MAPPING

2023-2024

9h

9h

Total: 45 h

Semester - VII

DATA ANALYSIS AND SIMULATIONS

3H-3C

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

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

Course Objectives

23BTBT7E07

The goal of this course is for students to

- Describe the concept of data preprocessing and visualization.
- Analyze the data using statistical tools.
- Discuss the mining frequent patterns
- Outline the usage of machine learning.
- Explain the artificial neural networks and its types.
- Apply the concepts of deep learning in biology and health care research

Course Outcomes

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

- 1. Summarize the data preprocessing and recall the types of data.
- 2. Illustrate the data using testing hypothesis and statistical tools.
- 3. Identify the mining frequent patterns.
- 4. Make use of the basic concept of machine learning to solve biological problems.
- 5. Apply the basic in the artificial neural networks and its types.

UNIT - I DATA PREPROCESSING AND VISUALIZATION 9h

Introduction to data preprocessing and visualization, Types of data, dealing with missing data, data visualization: Scatter Plot, histogram, group plots, box plots etc., dimensionality reduction. Simulation of random variables from discrete, continuous, multivariate distributions and stochastic processes, Monte-Carlo methods.

UNIT - II DATA ANALYSIS

Data analysis: Statistical analysis, hypothesis testing, significance of p-value, chi-square, T-test, ANOVA, Bayesian Probability.

UNIT - III MINING FREQUENT PATTERNS

Mining Frequent Patterns: Associations and Correlations, Classification. Regression analysis, scatter plot, residual analysis. Computer Intensive Inference Methods - Jack-Knife, Bootstrap, cross

9h

validation.

UNIT - IV MACHINE LEARNING

Machine learning: Supervised, unsupervised, logistic regression, SVMs, decision trees, clustering and model evaluation. Graphical representation of multivariate data, Cluster analysis, Principal component analysis for dimension reduction.

UNIT - V ARTIFICIAL NEURAL NETWORKS

Artificial neural networks: Types of ANN, case studies for the application of deep learning in biologyand health care research.

Text Books

- 1. Jeeva Jose. (2019). Introduction to Machine Learning using Python. Khanna Publishing House.
- 2. Ian Goodfellow, Yoshua Bengio. (2017). Deep Learning. MIT Press.

Reference Books

- 1. Kieran Healy. (2019). Data Visualization A Practical Introduction by, Princeton University Press.
- 2. Rajiv Chopra. (2019). Deep Learning. Khanna Publishing House.
- 3. Ethem Alpaydin. (2010), Introduction to machine learning, second edition.
- 4. Richard E. Neapolitan Xia jiang. (2018), Artificial intelligence with an introduction to machine learning.

Weblinks

1. https://gretel.ai/blog/data-simulation

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	1	-	-	-	-	-	-	-	2	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	1	-	1	-	-	-	-	-	-	-	2	-
CO4	3	2	1	-	1	-	-	-	-	-	-	-	2	1
CO5	3	2	1	-	1	-	-	-	-	-	-	-	2	1
Avg.	2.6	1.6	1	-	1	-	-	-	-	-	-	-	2	1

CO-PO MAPPING

9h

9h

Total: 45 h

B. Tech Biotechnology

2023-2024

23BTBT7E08

MARINE BIOTECHNOLOGY

Semester - VII **3H-3C**

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

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

Course Objectives

The goal of this course is for students to

- Explain descriptive properties of seawater.
- Illustrate differentiating marine organisms and their industrial applications.
- Compare various pollution controlling marine organisms.
- Evaluate various marine toxins used in pharmaceutical industries.
- Interpret recombination in marine aquaculture.
- Understand the usage of marine organism for different situations.

Course Outcomes

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

- 1. Summarize the basic knowledge on biogeochemical cycles.
- 2. Explain the marine organism production in different industries.
- 3. Outline pollution controlling measures through marine organisms.
- 4. Illustrate the basics on combining marine toxins in pharma industries.
- 5. Compare different proteins of marine organism to develop a new variety

UNIT-I INTRODUCTION TO MARINE ENVIRONMENT

World oceans and seas – ocean currents – physical and chemical properties of sea water – abiotic and biotic factors of the sea – ecological divisions of the sea – history of marine biology – biogeochemical cycles – food chain and food web.

UNIT-II MARINE ORGANISMS AND THEIR INDUSTRIAL APPLICATIONS 9h

Phytoplanktons – zooplanktons – nektons – benthos – marine mammals – marine algae – mangroves – coral reefs – algal products, fuels from algae, algal cell culture

UNIT-III MARINE ENVIRONMENTAL BIOTECHNOLOGY

Marine pollution – biological indicators (marine micro, algae) – biodegradation & bioremediation – marine fouling and corrosion.

9h

UNIT-IV MARINE PHARMACOLOGY

Medicinal compounds from marine flora and fauna – marine toxins, anti cancer agents, antiviraland antimicrobial agents. Marine Toxins

UNIT -V AQUACULTURE TECHNOLOGY

Importance of coastal aquaculture – marine fishery resources – common fishing crafts and gears – Aqua farm design and construction, transgenic fish.

Text Books

1. Fingerman. M. and Nagabhushanam. R. (2003). Recent advances in marine biotechnology volume 8. CRCPress

2. Fingerman. M. and Nagabhushanam. R. (1999). Recent advances in marine biotechnology volume 2. Sciencepublishers

Reference Books

 Becker, E. W. (1994). Microalgae: Biotechnology and Microbiology. Cambridge UniversityPress
Lee. J. S. and Newman. M. E. (1996). Aquaculture: An Introduction. Interstate Publishers, Incorporated

Web links

1. https://www.marinebiotech.eu

	COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CODE														
	CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	2
	CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
	CO3	2	1	-	-	-	-	-	-	-	-	-	-	1	2
	CO4	2	1	-	-	1	1	-	-	-	-	-	-	1	2
	CO5	2	1	-	-	1	1	-	-	-	-	-	-	-	2
ſ	Avg.	2	1	-	-	1	1	-	-	-	-	-	-	1	2

CO-PO MAPPING



23BTBTOE01

BASIC BIOINFORMATICS

3H-3C

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

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

Course Objective

The goal of this course is for students to

- Elaborate the available tools and databases for performing research in bioinformatics.
- Expose students to sequence alignment tool in bioinformatics.
- Construct the phylogenetic trees for evolution.
- Discuss the 3D structure of protein and classification.
- Acquire basic knowledge in protein secondary structure prediction.

Course Outcomes

After completing the course, the students will be able to

- 1. Summarize the basic concepts of bioinformatics.
- 2. Outline the sequence retrieval and analysis tools using bioinformatics.
- 3. Infer the methods used to construct phylogenetic tree for evolution analysis.
- 4. Apply the protein structure knowledge for modeling
- 5. Make use of bio-informatics principles towards biological applications.

UNIT I: OVERVIEW OF BIOINFORMATICS

Aims and tasks of Bioinformatics - applications of Bioinformatics - challenges and opportunities. The scope of bioinformatics; bioinformatics & the internet; useful bioinformatics sites. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene & protein expression data; protein interaction data. Databases – contents, structure & annotation: file formats; annotated sequence databases; miscellaneous databases.

UNIT II: RETRIEVAL OF BIOLOGICAL DATA

Data retrieval with ENTREZ & DBGET/ Link DB; data retrieval with SRS (sequence retrieval system). Searching sequence databases by sequence similarity criteria: sequence similarity searches; amino acid substitution matrices; database searches, FASTA & BLAST; sequence filters; iterative database searches & PSI-BLAST. Multiple-sequence alignment, gene & protein families: multiple-sequence alignment & family relationships; protein families & pattern databases; protein domain families.

9h

9h

9h

9h

UNIT III: PHYLOGENETICS

Introduction to Phylogenetics, Molecular Evolution and Molecular Phylogenetics, Phylogenetic tree, Forms of Tree Representation, Rooted and un-rooted trees, Phylogenetic Tree Construction Methods: Distance based methods- NJ, UPGMA PGMA, cladistics & ontology; building phylogenetic trees; evolution of macromolecular sequences. Sequence annotation: principles of genome annotation; annotation tools & resources.

UNIT IV: STRUCTURAL BIOINFORMATICS

Conceptual models of protein structure; the relationship of protein three-dimensional structure to protein function; the evolution of protein structure & function; obtaining, viewing & analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure; Protein sequence data-bases- SwissProt/ TrEMBL, PIR, Sequence motif databases -Pfam,PROSITE, Protein structure databases, Protein Data Bank-SCOP, CATH, KEGG, Chembank, Sequence, structure and function relationship.

UNIT V: APPLICATIONS OF BIOINFORMATICS

Microarray data, analysis methods; microarray data, tools & resources; sequence sampling & SAGE. Bioinformatics in pharmaceutical industry: informatics & drug discovery; pharma informatics resources. Basic principles of computing in bioinformatics: running computer software; computer operating systems; software downloading & installation; database management.

Total: 45h

TEXT BOOKS

- 1. Dan E krane Michael L Rayme. (2004). Fundamental concepts of Bioinformatics. Pearson Education.
- 2. Andreas D Baxevanis B.F. Franchis Ouellette. (2004). Bioinformatics: A practical guide to the analysis of genes and proteins. Wiley-Interscience.
- 3. David W. Mount. (2004). Sequence and Genome Analysis. Cold Spring Harbor Laboratory.

REFERENCE BOOKS

- 1. Jonathan Pevsner. (2015). Bioinformatics and functional genomics. wiley-Liss.
- 2. Rastogi, S. C., Parag Rastogi, and Namita Mendiratta (2013). Bioinformatics Methods And Applications: Genomics Proteomics And Drug Discovery. 4 th Edition, PHI Learning Pvt. Ltd.,

WEB SITES

- 1. https://www.ncbi.nlm.nih.gov/pmc/
- 2. <u>https://biology.mit.edu/faculty-and-research/areas-of-research/computational-biology/</u>

CO-PO MAPPING

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	1	-	-	-	-	-	-	-	-	-	2	2	-
CO2	2	1	-	-	1	-	-	-	-	-	-	1	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	1	-	1
CO4	3	2	2	-	1	1	-	-	-	-	-	2	2	-
CO5	3	2	2	1	-	-	-	-	-	-	-	2	1	-
Avg.	2.4	1.0	2.0	1.0	1.0	1.0	-	-	-	-	-	1.6	1.6	1.5

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23BTBTOE02 FUNDAMENTALS OF NANOBIOTECHNOLOGY **3H-3C**

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

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

Course Objectives

The goal of this course is for students to

- Impart the skills in the field of nanotechnology and its applications.
- Acquire knowledge in nano particle synthesis and its characterization.
- Gain the basic knowledge on the application of bionanomaterials in biotechnology •
- Provide the knowledge in the field of medical nanotechnology. •
- Analysis the ethical issues involve in nnanotechnology •

Course Outcomes

After completing the course, the students will be able to

- 1. Summarize the basics of nanotechnology and its applications.
- 2. Outline the techniques involves in nanoparticles synthesis and characterization.
- 3. Apply the principles of biomolecules for the fabrication of nanoparticles
- 4. Develop nanoscale devices for the medical applications.
- 5. Analyze the socio-economic and ethical issues in Nano biotechnology.

UNIT I: INTRODUCTION TO NANOTECHNOLOGY

Introduction to Nanotechnology: Properties at nanoscale, Scope and Overview, Importance of Nanoscale and Technology, History of Nanotechnology, Future of Nanotechnology: Nano Technology Revolution; Silicon based Technology, Nanotechnology in Different, Application of Nanotechnology

UNIT II: NANO PARTICLES

Types of Nanoparticles, Techniques to Synthesize Nanoparticles, Introduction, Characterization of Nanoparticles- MEMS/NEMS, Atomic Force Microscopy, Self-assembled monolayers/ Dip- pen Nanolithography, Soft Lithography, PDMS Molding, Nano Particles, Nano wires and Nanotubes. X-ray diffraction technique; Scanning Electron Microscopy with EDX; Transmission Electron Microscopy including high-resolution imaging.

UNIT III: BIONANOMATERIALS

Bionanomaterials- Introduction, biomolecule for designing nanostructures, properties of DNA and motor proteins, fabrication and applications of DNA nanowires, nanoprinting of DNA, RNA and proteins; DNA nanostrucutres, DNA robot, DNA microarrays, Bio-MEMS, Biological and medical applications of bionanomaterials

9h

9h

UNIT IV: MEDICAL NANOTECHNOLOGY

Nanomedicine, Nanobiosensor and Nanofludics. Nanocrystals in biological detection, Electrochemical DNA sensors and Integrated Nanoliter systems. Nano-Biodevices and Systems. Fabrication of Novel Biomaterials through molecular self assembly- Small scale systems for in vivo drug delivery- Future nanomachine. Case study on drug delivery ofgold nanoparticles against breast cancer

UNIT V: ETHICAL ISSUES IN NANOTECHNOLOGY

Introduction, Socioeconomic Challenges, Ethical Issues in Nanotechnology: With Especial Reference to Nanomedicine, Nanomedicine Applied in Nonmedical Contexts, Social Issues Relating to Nanomedicine. Social and Ethical Issues, Economic Impacts, OtherIssues, Nanotechnology and Future Socio-economic challenges.

TEXT BOOKS

- 1. Goodsell, D.S. (2004). Bionanotechnology. John Wiley and Sons, Inc.
- 2. Shoseyov, O. and Levy, I (2008).Nanobiotechnology: Bioinspired Devices and Materials of the Future. Humana Press.

REFERENCE BOOKS

- 1. Bhushan, B. (2017). Springer Handbook of Nanotechnology. Springer-VerlagBerlin Heidelberg.
- 2. FreitasJr R.A (2006) Nanomedicine. Landes Biosciences.
- 3. Kohler, M. and Fritzsche, W. (2008). Nanotechnology An Introduction toNanostructuring Techniques. Wiley-VCH.
- 4. Niemeyer, C. M., and CA Mirkin, C. A., (2010); NanoBiotechnology II Moreconcepts, and applications. First edition, Wiley –VCH publications

WEB SITES

- 1. <u>https://mitnano.mit.edu/</u>
- 2. https://nptel.ac.in/courses/118102003

9h

9h

Total:45h

CO-PO MAPPING

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CODE														
CO1	2	-	-	-	-	-	-	-	-	-	2	-	2	-
CO2	2	1	1	-	1	-	-	-	-	-	1	-	-	2
CO3	3	2	2	1	-	-	-	-	-	-	1	-	-	2
CO4	2	-	1	1	1	-	-	-	-	-	2	-	1	-
CO5	3	2	2	2	-	-		2	-	-	-	-	-	2
Avg.	2.4	1.6	2.0	1.3	1.0	-	-	2.0	-	-	1.5	-	1.5	2.0

23BEBMEOE01 HUMAN ANATOMY AND PHYSIOLOGY

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

3H-3C

Marks: Internal: 40 External:60 Total:100

End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for students

- To discuss all the organelles of an animal cell and their function. •
- To perceive structure and functions of the various types of systems of human body. •
- To outline about eye, ear and Endocrine glands of human
- To learn organs and structures involving in system formation and functions.
- To infer basic understanding of the inter connection of various organ systems in human body

COURSE OUTCOMES:

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

- Explain basic structure and functions of cells and its organelles
- Elucidate the Nervous Control system of Heart
- Classify respiration types and its function
- Illustrate the functions of Digestion and absorption system
- Differentiate the functions of sensory organs and Endocrine glands of human

UNIT I CELL

Structure of Cell- Organelles and description-Function of each component of the cell- Membrane potential-Action Potential-Generation and Conduction -Electrical Stimulation. Blood Cell-Composition -Origin of RBC-Blood Groups-Estimation of RBC, WBC and Platelet- Tissues and its functions-.Homeostasis - Tissue: Types - Specialized tissues - functions.

UNIT II CARDIAC AND NERVOUS SYSTEM

Heart, Major blood vessels- Cardiac Cycle - ECG-Conducting system of heart--importance of blood groups - identification of blood groups- Nervous Control of Heart-Cardiac output- Coronary and Peripheral Circulation-Structure and function of Nervous tissue-Neuron-Synapse- Reflexes-Receptors-Brain-Brainstem-Spinalcord-Reflexaction.

UNIT III RESPIRATORY SYSTEM AND MUSCULO SKELETAL SYSTEM

Physiological aspects of respiration-Trachea and lungs -Exchange of gases-Regulation of Respiration Disturbance of respiration function -Pulmonary function test-Types of respiration - Oxygen and carbon dioxide transport and acid base regulation-Muscles-tissue-types-structure of skeletal muscle-types of muscle and joints.

UNIT IV DIGESTIVE, EXCRETORY AND LYMPHATIC SYSTEM

Organisation of GI System, Digestion and absorption -Movements of GI tract-Intestine-Liver-Pancreas- Structure of Nephron-Mechanism of Urine formation-Urine Reflex-Skin and Sweat

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Gland–Temperature regulation, Lymphatic: Parts and Functions of Lymphatic systems– Types of Lymphatic organs and vessels.

UNIT V EYE, EAR & ENDOCRINE GLANDS

Optics of Eye–Retina–Photochemistry of Vision–Accommodation-Neurophysiology of vision–EOG, Physiology of internal ear–Mechanism of Hearing–Auditory Pathway, Hearing Tests–Endocrine-Pituitary and thyroid glands.

TOTAL: 45

TEXT BOOKS:

1. Textbook Equity Edition, Anatomy and Physiology : Volume 2 of 3, Lulu.com, 2014

REFERENCES:

- William F. Ganong, Review of Medical Physiology, Mc Graw Hill, New Delhi, 26th Edition, 2019
- 2. Arthur C. Guyton, Text book of Medical Physiology Elsevier Saunders, 12th Edition, 2011

WEB SITES:

- 1. https://dth.ac.in/medical/course.php
- 2. https://onlinecourses.swayam2.ac.in/cec20_bt19/preview

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

CO PO MAPPING

23BEBMEOE02 ARTIFICIAL ORGANS AND IMPLANTS

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

COURSE OBJECTIVES:

The goal of this course is for students

- To have an overview of artificial organs &transplants
- To describe the principles of implant design with a case study
- To explain the implant design parameters and solution
- To study about various blood interfacing implant
- To study about soft tissue replacement and hard tissue replacement

COURSE OUTCOMES:

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

- Compare the fundamentals of Artificial organs and Transplants
- Explain the implant design parameters and solution in use
- Interpret the response of biomaterials in living system
- Choose blood interfacing implants
- Differentiate soft and hard tissue replacements

UNIT I ARTIFICIAL ORGANS & TRANSPLANTS

ARTIFICIAL ORGANS:-Introduction, Outlook for organ replacements, Design consideration – Evaluation process. TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, Individualorgans – kidney, liver, heart and lung, bone marrow, cornea.

UNIT II PRINCIPLES OF IMPLANT DESIGN

Principles of implant design - body response to implants, Clinical problems requiring implants for solution, The missing organ and its replacement, Tissue engineering, scaffolds, Biomaterials, Regenerative medicine & Stem cells.

UNIT III IMPLANT DESIGN PARAMETERS AND ITS SOLUTION

Biocompatibility, Local and systemic effects of implants, Design specifications for tissue bonding and modulus matching, Degradation of devices, natural and synthetic polymers, corrosion, wear and tear, Implants for Bone, Devices for nerve regeneration. Limb prosthesis, Externally Powered limb Prosthesis.

UNIT IV BLOOD INTERFACING IMPLANTS

Neural and neuromuscular implants, Heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, Prosthetic cardiac valves, Artificial kidney-dialysismembrane and artificial blood.

UNIT V IMPLANTABLE MEDICAL DEVICES AND ORGANS

Gastrointestinal system, Dentistry, Soft tissue replacement & Hard tissue replacement – sutures, surgical tapes, adhesive, percutaneous implants, internal fracture fixation devices, joint replacements.

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3H-3C

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

2023-2024

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Maxillofacial and craniofacial replacement, Recent advancement and future directions.

TOTAL: 45

TEXT BOOKS:

1. Kopff W.J, Artificial Organs, John Wiley and sons, New York, 1st edition, 1976

2. Park J.B, Biomaterials Science and Engineering, Plenum Press, 2011

REFERENCES :

1. J D Bronzino, Biomedical Engineering handbook Volume II, (CRC Press / IEEE Press), 2000.

- 2. R S Khandpur, Handbook of Biomedical Instrumentation, Tata Mc Graw Hill, 2003
- 3. Joon B Park, Biomaterials An Introduction, Plenum press, New York, 1992.

4. Yannas, I. V, —Tissue and Organ Regeneration in Adults^{II}, New York, NY: Springer, 2001.

5. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph D, Bronzino, Clinical Engineering^{II}, CRC Press, 1st edition, 2010.

6. Standard Handbook of Biomedical Engineering & Design , Myer Kutz, McGraw-Hill, 2003

WEB SITES:

1.https://ocw.mit.edu/courses/mechanical-engineering/2-782j-design-of-medical-devices-and-implants-spring-2006/

CO PO MAPPING

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

23BTFTOE01 PROCESSING OF FOOD MATERIALS

3H-3C

9

9

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

Course Objectives

The goal of this course is for students to,

- To explain the milling, extraction and manufacture of tremendous productsfrom cereals, pulses and oil seeds.
- To summarize the production and processing methods of fruits and vegetables.
- To infer the chemical composition, processing, production, spoilage and quality of milk and milk products.
- To outline the overall processes involved in the production of meat, poultry and fish products.
- To review the production and processing methods of plantation and spice products.

Course Outcomes

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

- Infer the basics of food processing.
- Demonstrate the various processing technologies involved in fruits and vegetables, dairy, cereals, meat, fish, egg and plantation products.
- Infer the basics on microbiology of food products.
- Summarize the process of manufacture of various food products.
- Outline the various methods of food preservation.

UNIT I - CEREAL, PULSES AND OIL SEEDS TECHNOLOGY

Rice milling, Pulse milling, Wheat milling – Recent trends in milling process- Oil extraction – different methods in oil extraction - Methods of manufacture of Bread - different processes of manufacture - types of breads - buns, biscuits, cakes and cookies - Pasta products - Tortilla - Method of manufacture.

UNIT II - FRUITS AND VEGETABLE PROCESSING

Production of Fruits and vegetables in India, Maturity standards, Cause for heavy losses, preservation treatments - Basics of Canning, Minimal processing and Hurdle technologyas applied to Vegetable and Fruit processing, Processing of fruit juices, Dehydration, Aseptic processing- Indian Food Regulation and Quality assuranceFruit Juice / pulp/ Nectar/Drinks, concentrates.

UNIT III – DAIRY PROCESSING

Basic dairy terminology, composition, General tests at reception, Dairy Processing -Method of manufacture of Standardized, toned and double toned milk, milkpowder -Equipments - Pasteurizers, homogenizers and pumps - Method of manufacture of dairy products - Ice-cream, Cheese, Paneer, Yoghurt - Pasteurization and microorganisms involved in spoilage of milk – Major pathogens, Plant construction, Sanitation management, Cleaning equipment.

UNIT IV - MEAT, POULTRY AND FISH PROCESSING

Meat composition from different sources, Definitions and measurements, Carcass Processing, Meat Products, Processing of Poultry Products, Common pathogens, Sanitation management, Sanitizers for meat & poultry plants, Fish and other Marine Products Processing, Sources of sea food contamination.

UNIT V - PLANTATION PRODUCT TECHNOLOGY

Processing of Tea, Coffee and Cocoa - Outline of the methods of manufacture of - green tea, black tea, instant tea, Instant coffee, Cocoa and Chocolate. Outline of the methods of processing of Pepper, cardamom, ginger, vanilla and turmeric. By products from plantation crops and spices.

TEXT BOOKS:

- 1. Srivastava R.P. and Kumar S. Fruit and Vegetable Preservation: Principles and Practices. International Book Distributing Co. Lucknow. 3rd Edition. 2010.
- 2. Chakraverty A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S. Handbook of Post- harvest Technology: Marcel Dekker Press. USA. 1st Edition. 2003.

REFERENCE BOOKS:

- 1. Sukumar De. Outlines of Dairy Technology. Oxford University Press. New Delhi.23rd impression. 2016.
- 2. James G. Brennan. 2006. Food Processing Handbook. Wiley-VCH Verlag GmbH& Co. KGaA, Weinheim, Germany.

WEB REFERNCES

- 1. https://www.intechopen.com/chapters/86251
- 2. https://ifst.onlinelibrary.wiley.com/journal/17454549

CO PO Mapping

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	1	-	-
Avg.	2	1	-	-	-	-	-	-	•	-	-	1	-	-

9

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TOTAL: 45

NUTRITION AND DIETETICS

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

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

Course objectives

The goal of this course is for students,

- To explain the basic concepts of food and nutrition.
- To define the overall classification, function, and source of carbohydrates, lipids and proteins.
- To summarize the availability, source, deficiency and physiological role of fat andwater-soluble vitamins.
- To outline the role of health and nutritional importance of micro and macro minerals.
- To interpret the recent trends and developments in nutrition.

Course outcomes

Upon successful completion of this, students will be able to

- 1. Explain the basics in the area of nutritional assessment in health and disease.
- 2. Outline the biological functions of various macromolecules in terms of food and health.
- 3. Summarize the balanced diet for healthy life to avoid or prevent the deficiency disorders.
- 4. Infer an appropriate diet, products that prevent vitamin deficiency disorders.
- 5. Identify the proper foods rich in minerals to live a healthy life.

UNIT I - HUMAN NUTRITION

Six classes of nutrients - Historical perspective of nutrient requirements – Assessment of nutritional status - recommended dietary allowances of macronutrients for all age groups - Assessment of protein quality - Malnutrition and related disorders –Balanced Diet. Factors influencing dietary intake: Food habits, food fads and fallacies, their influence on health and wellbeing.

UNIT II - BIOMOLECULES

Carbohydrates- Definition, classification, Functions, Sources of Carbohydrates, Deficiency. Lipids – Definition, classification, function, sources, Properties of fats and oils, Refined & Hydrogenated fats process. Proteins - Definitions, Classification, Function, Amino Acids, Sources of Proteins, Texturized proteins.

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UNIT III - VITAMINS

Physiological role, bio-availability, requirements, sources and deficiency of Fat-Soluble Vitamins: Vitamin A, Vitamin D, E & K. *f* Water soluble vitamins: Vitamin C, Thiamine, Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12, VitaminB6. Stability under different food processing conditions.

UNIT IV – MINERALS AND WATER

Physiological role, bio-availability, requirements, sources and deficiency of Macro minerals: Calcium, Phosphorus Magnesium, Sodium, Potassium chloride. Micro minerals: Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride - Chemistry and physical properties of free, bounded and entrapped water,water activity, quality parameters of drinking and mineral water.

UNIT V - RECENT TRENDS IN NUTRITION

Principles of dietary management in gout, rheumatism, AIDS/HIV - Cancer-risk factors, symptoms, dietary management, role of food in prevention of Cancer. Role of functional foods Health foods and novel foods, organically grown foods, personalized nutrition, recent concepts in human nutrition like nutrigenomics, nutraceuticals etc.

TOTAL: 45

TEXT BOOKS:

- 1. Sunetra Roday. Food Science and Nutrition. Oxford Higher Education/Oxford University Press. 3rd edition 2018. (ISBN-13: 9780199489084).
- 2. Charis Galanakis. Nutraceutical and Functional Food Components. Academic Press, 1st Edition, 2017. (ISBN: 9780128052570).
- Ashley Martin. Nutrition and Dietetics. Syrawood Publishing House. 1st Edition, 2016. (ISBN:9781682860588).

REFERENCE BOOKS:

- 1. Robert E. C. Wildman. Handbook of Nutraceuticals and Functional Foods. CRC Press, 2nd Edition, 2016. (ISBN-10: 9781498770637).
- Srilakshmi. B. Nutrition Science. New Age International Pvt. Ltd, Publishers. 6th Edition. 2017. (ISBN-13: 9789386418883).

WEB REFERENCES

- 1. https://onlinelibrary.wiley.com/journal/17470080
- 2. https://aub.edu.lb.libguides.com/c.php?g=276518&p=1842999

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CO- PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PS
														02
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	I
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	-
Avg.	2.2	1.2	1	-	-	-	-	-	-	-	-	1	-	-

23BTFTOE03 READY TO EAT FOODS

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

Course Objectives

The goal of this course is for students to,

- To outline the current status of snack food Industry.
- To describe the production, processing and marketing trends of potato and tortillachips.
- To outline the overall processing of popcorn.
- To explain the production and processing of fruits involved in snack food preparation.
- To summarize the sensory analysis methods and packaging techniques of snack foods.

Course Outcomes

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

- 1. Outline the various manufacturing process in snack food industries.
- 2. Summarize the current production and marketing status of Snack foods.
- 3. Explain the advantages of Sensory Evaluation.
- 4. Infer packaging technologies in Snack Food Industries.
- 5. Demonstrate the equipment's involved in the snack production processes.

UNIT I - INTRODUCTION TO SNACK FOODS

Introduction- Types – processing methods - Nutrition- Quality and standards for snack foods - GHP and GMP for snack food industries - Outline of snack food industry - Domestic Snack Food Market-Global Market.

UNIT II - POTATO AND TORTILLA CHIPS PROCESSING

Potato Production- selection and grading of potato - Potato snack Ingredients- Potato Analysis and Composition-Potato chip manufacturing process-Unit Operations-Other value added products from Potato. Tortilla chips - Raw Materials- Processing steps-Equipment involved-Reconstitution of Dry Maize Flour-Unit operations - Nutritional properties of potato and tortilla chips.

UNIT III - POPCORN PROCESSING

Introduction- Raw popcorn selection and preparation-Popping Methods-Home preparation of Popcorn-Equipment's-Industrial manufacturing process- Flavorings and Applicators-Popcorn Packaging- Relative Nutrition- Marketing.

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UNIT IV - FRUIT BASED SNACKS

Introduction-production and processing of fruit crops – fruit purees – fruit powders – canned fruit snacks – alcoholic preservation of fruit snacks – fruit candies – fruit bars – exotic fruits – Nutrition's and health benefits of fruit snacks.

UNIT V - SENSORY EVALUATION AND PACKAGING

Introduction- importance of sensory evaluation – Analytical methods -Sensory methods-Sensory Aspect of Processing- Limitations of sensory evaluation- Quality properties of Snack Foods and Packaging Materials-Automated Bag- Pouch Packaging- Cartoning Case Packing- Labelling requirements - Current Issues in Snack Foods Packaging.

TOTAL: 45

TEXT BOOKS:

- Lusas, E. W and Rooney, L. W. Snack Foods Processing. CRC Press,1st Edition 2001.
- 2. Panda, H. The Complete Technology Book on Snack Foods, National Institute of Industrial Research, Delhi. 2nd Edition 2013.
- *3.* Sergio O Serna-Saldivar, Industrial Manufacture of Snack Foods, Kennedys Books Ltd. 2008.

REFERENCE BOOKS:

- Lusas, E. W and Rooney, L. W. Snack Foods Processing. CRC Press,1st Edition 2001.
- 2. Panda, H. The Complete Technology Book on Snack Foods, National Institute of Industrial Research, Delhi. 2nd Edition 2013.
- 3. Sergio O Serna-Saldivar, Industrial Manufacture of Snack Foods, Kennedys Books Ltd. 2008.

WEBLINKS:

- 1. https://www.sciencedirect.com/book/9780128019160/food-hygiene-and-toxicology-in-ready-to-eat-foods
- 2. https://www.eurofins.in/blog/food-testing/ready-to-eat-food-testing/

CO PO Mapping

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

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23BTFTOE04 AGRICULTURAL WASTE AND BYPRODUCTS 3H-3C UTILIZATION

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

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

Course Objectives

The goal of this course is for students,

- To classify the types of agricultural wastes.
- To outline the production and utilization of biomass.
- To explain the various parameters considered to be important in the designing of biogas units.
- To outline the methods employed in the production of alcohol from agricultural wastes/byproducts.
- To summarize the overall aspects involved in the production of paperboards and particleboards from agricultural wastes.

Course Outcomes

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

- 1. Outline the types of agricultural wastes.
- 2. Illustrate the collection and generation of value-added products from agricultural wastes
- 3. Demonstrate the techniques involved in the production and utilization of biomass.
- 4. Infer the various parameters considered to be important in the designing of biogas units.
- 5. Illustrate the various methods employed in the production of alcohol from thebyproducts of agricultural wastes.

UNIT I - TYPES OF AGRICULTURAL WASTES

Introduction and Background Agricultural Waste, Crop Waste, Agricultural Residues (annual crops), Technical terms, properties of agricultural waste- storage and handling - rice by-products utilization-rice bran and germ, rice bran oil, economic products from agriculture waste/by-products.

UNIT II - BIOMASS PRODUCTION AND UTILIZATION

Biomass – types – production and utilization Technology used for the utilization of agricultural wastes: Biomass Gasifier, Nimbkar Agricultural Research Institute (NARI) Gasifier, Rice-Husk Based Gasifier, Heat and Steam from Sugarcane Leaf and Bagasse.

UNIT III - BIOGAS DESIGN AND PRODUCTION

Biogas: Definition, composition, history of biogas, Production of biogas – factors affecting the efficiency; types of biogas plant (floating drum type and fixed dome type) and their components (inlet, outlet, stirrer, slanting pipe, digester, gas holder and gas outer pipe), Selection and Design of biogas plant.

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UNIT IV - PRODUCTION OF ALCOHOL FROM WASTE MATERIALS 9

Production of Alcohol from waste materials: Introduction, Production methods, Cellulolysis (biological approach): Pretreatment, Cellulolytic processes (Chemical and Enzymatic hydrolysis), Microbial fermentation, Gasification process (thermochemical approach).

UNIT V – PRODUCTION OF PAPERBOARD AND PARTICLEBOARDS FROMAGRICULTURAL WASTE 9

Biodegradable packing materials: merits and demerits, Production and testing of Paperboards and Particleboards from Agricultural Waste: Introduction, History, Terminology and classification, Raw materials, Production steps- Pulping, Classifications of pulp, Bleaching, Plies, Coating, Grades.

TEXT BOOKS:

- 1. Efthymia Alexopoulou. Bioenergy and Biomass from Industrial Crops on Marginal Lands. Elsevier, 1st Edition, 2020. (ISBN: 9780128188644).
- Navanietha Krishnaraj Rathinam, Rajesh Sani. Biovalorisation of Wastes to Renewable Chemicals and Biofuels. Elsevier, 1st Edition, 2019. (ISBN: 9780128179529).
- 3. Simona Ciuta, Demetra Tsiamis, Marco J. Castaldi. Gasification of Waste Materials. Academic Press, 1st Edition, 2017. (ISBN: 9780128127162).

REFERENCE BOOKS:

- Nicholas E. Korres, Padraig O'Kiely, John A.H. Benzie, Jonathan S. West. Bioenergy Production by Anaerobic Digestion: Using Agricultural Biomass and Organic Wastes. Routledge, 1st Edition, 2013. (ISBN-13: 9780415698405).
- 2 Albert Howard, Yashwant Wad. The Waste Products of Agriculture. Benediction Classics, 1st Edition, 2011. (ISBN-13: 9781849025).

WEB REFERENCES:

- 1. https://www.researchgate.net/publication/308880744_AGRICULTURAL_WAST E_CONCEPT_GENERATION_UTILIZATION_AND_MANAGEMENT
- https://bioresourcesbioprocessing.springeropen.com/articles/10.1186/s40643-017-0187-z

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

CO PO Mapping

TOTAL: 45

23BTFTOE05 DESIGN OF FOOD PROCESS EQUIPMENT 3H-3C

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

Course Objective

The goal of this course is for students to,

- To illustrate the types of materials used in the food processing equipment's.
- To outline the materials and designing of different storage vessel.
- To explain the importance of reaction vessel and their deskinning techniques.
- To interpret the materials and designing of heat exchanger and evaporators.
- To summarize the importance of dryers in food processing industries.

Course Outcome

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

- Outline the materials suitable for the construction of equipment's.
- Summarize the vessels used for food storage in the industries.
- Classify types of reaction vessel used for different purposes.
- Infer the importance of heat exchanger in the designing of food processing equipment's.
- Infer the significance of dryers in food processing.

UNIT I - MATERIALS

Metals and non-metals, design of pressure vessels – cylindrical shell –internal and external pressure - under continued loadings. Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion preventionlinings equipment, choice of materials, material codes Numerical problem and design of pressure vessel.

UNIT II - STORAGE VESSELS

Design of storage vessels – Rectangular Tank without stiffeners – with stiffeners – shelldesign – Numerical problem and design. Design of agitators and baffles. Designconsiderations: Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations;

UNIT III - REACTION VESSELS

Design of Reaction vessels – materials -classification – jackets-Design of vessel shell with half coil – Design of vessel shell with jacket – Numerical problem and design.

Hazards in process industries, analysis of hazards, safety measures, safety measures in equipment design, pressure relief devices.

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UNIT IV - HEAT EXCHANGERS

Design of Heat exchangers – types – materials – Design pressure and temperature- shelldesign – tubes - Numerical problem. -Design of Equipment. Evaporator: Materials of concentration - types - designconsideration – Design of agitators – power requirements – Design based on Torque – criticalspeed.

UNIT V – DRYERS

Types - General considerations – Design of Tray dryer, Rotary Dryer, fluidized bed dryer, spray dryer, vacuum dryer, microwave dryer – Material Balance, Thermal energyRequirements, electrical energy Requirements, Performance Indices

TEXT BOOKS:

- 1. Maroulis Z.B. and Saravacos G.D. Food Process Design, Marcel Dekker Inc.ISBN-0824743113, 2003.
- Joshi M.V, "Process Equipment Design", Macmillan India Ltd., 1985. 2.

REFERENCE BOOKS:

1. Coulson, J.M. and Richardson, J. F,"Chemical Engineering "Butterworth-HeinemnnElsevier, ISBN-0750644451, 2002.

WEBLINKS:

- 1. https://onlinelibrary.wiley.com/toc/17454530/2022/45/6
- 2. https://link.springer.com/chapter/10.1007/978-1-4615-2193-8_7

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	1	-	-
Avg.	2	1	-	-	-	-	-	-	-	-	-	1	-	-

CO PO Mapping

TOTAL: 45
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23BECEOE01

HOUSING PLAN AND MANAGEMENT

3H-3C

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

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

COURSE OBJECTIVES:

- To examine the role and tasks of basic housing policies and building bye laws
- Understand the process of integrated service delivery in the context of economic, social, environmental, and institutional factors.
- Analyze the Innovative construction methods and Materials.
- Analyze city management strategies and strengthen the urban governance through a problem-solving approach.
- To know the Importance of basic housing policies and building bye laws
- To use Housing Programmes and Schemes

COURSE OUTCOME:

After completing the course, the students will be able to

- Know the Importance of basic housing policies and building bye laws.
- Use Housing Programmes and Schemes
- Plan and Design of Housing projects
- Examine Innovative construction methods and Materials.
- Know Housing finance and loan approval procedures.
- Understand Construction as well as managing techniques.

UNIT I INTRODUCTION TO HOUSING

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Byelaws at Urban and Rural Local Bodies – levels – Development Control Regulations, Institutions for Housing at National, State and Local levels

UNIT II HOUSING PROGRAMMES

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organizations.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS 9

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers

- Concept, Functions and Performance Evaluation.

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern (Problems).

TEXTBOOKS

- 1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd.,New Delhi, 2002.
- 2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Mumbai (Bombay), 2001.

REFERENCES

- 1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
- 2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS

CO PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	-	-	2	-	2	2	-	-
CO2	3	3	3	3	3	2	-	-	2	-	2	2	-	-
CO3	3	3	2	2	2	2	-	-	2	-	2	2	-	-
CO4	3	3	3	3	2	2	I	I	2	-	2	2	-	-
CO5	3	3	2	2	2	2	I	I	2	-	2	2	I	-
Avg.	3	3	2.6	2.4	2.2	2	-	-	2	-	2	2	-	-

BUILDING SERVICES 3H-3C 23BECEOE02

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

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

COURSE OBJECTIVES

- Defining and identifying of engineering services systems in buildings.
- The role of engineering services systems in providing comfort and facilitating life of users • of the building.
- The basic principles of asset management in a building & facilities maintenance environment
- Importance of Fire safety and its installation techniques.
- To understand Electrical system and its selection criteria
- To use the principles of illumination & design ٠

COURSE OUTCOME

After completing the course, the students will be able to

- Machineries involved in building construction. •
- Understand Electrical system and its selection criteria. •
- Use the Principles of illumination & design.
- Know the principle of Refrigeration and application.
- Importance of Fire safety and its installation techniques •
- Know the principle behind the installation of building services and to ensure safety in buildings.

UNIT I MACHINERIES

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly - Conveyors - Vibrators - Concrete mixers - DC/AC motors - Generators -Laboratory services – Gas, water, air, and electricity.

UNIT II ELECTRICAL SYSTEMS IN BUILDINGS

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiringsystems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations.

UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation - saturation temperature - Super heated vapor-Sub cooled liquid - Pressure temperature relationship for liquids - Refrigerants - Vapor compression cycle – Compressors – Evaporators –Refrigerant control devices – Electric motors – Starters - Air handling units - Cooling towers - Window type and packaged air-conditioners -

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Chilledwater plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems.

UNIT III PRINCIPLES OF ILLUMINATION & DESIGN

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis oflight – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilization factor – Depreciation factor – MSCP – MHCP –Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals, and house lighting. Elementary idea of specific features required, and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT V FIRE SAFETY INSTALLATION

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like noncombustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems.Specific features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers.

TEXTBOOKS

- 1. E.R.Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 2002.
- 2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 2005.

REFERENCES

- 1. Philips Lighting in Architectural Design, McGraw-Hill, New York, 2000.
- 2. A.F.C. Sherratt, "Air-conditioning and Energy Conservation", The Architectural Press, London, 2005.
- 3. National Building Code.

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

CO PO MAPPING

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23BECEOE03 REPAIR AND REHABILITATION OF STRUCTURES 3H- 3C

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

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

COURSE OBJECTIVES

- To learn various distress and damages to concrete and masonry structures
- To know the influence of corrosion in durability of structures
- To understand the importance of maintenance of structures
- To study the various types and properties of repair materials
- To learn various techniques involved in demolition of structures.
- To Assessing damage of structures and various repair techniques.

COURSE OUTCOME

After completing the course, the students will be able to

- Various distress and damages to concrete and masonry structures.
- Durability of structures and corrosion mechanism
- The importance of maintenance of structures, types, and properties of repair materials etc.
- Assessing damage of structures and various repair techniques
- the several types and properties of repair materials
- Modern technique and equipment being adopted for the demolition of structures

UNIT I INTRODUCTION

Quality assurance for concrete construction as built concrete properties strength, permeability, thermalproperties, and cracking. Effects due to climate, temperature, chemicals, wear and erosion, Design, and construction errors.

UNIT II DURABILITY OF STRUCTURES

Corrosion mechanism – diagnosis- causes and effects - cover thickness and cracking, measurements for corrosion - methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT III MAINTENANCE AND REPAIR STRATEGIES

Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT IV MATERIALS FOR REPAIR

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete. eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete.

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UNIT V TECHNIQUES FOR REPAIR AND REPAIR OF STRUCTURES

Non-destructive Testing Techniques, Corrosion protection techniques ,Gunite and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning. Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure Engineered demolition techniques for dilapidated structures - case studies.

TEXT BOOKS:

- 1. Denison Campbell, Allen, and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair," Longman Scientific and Technical UK, 1991.
- 2. Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987
- 3. Shetty M.S., "Concrete Technology Theory and Practice," S. Chand and Company, 2008.

REFERENCE BOOKS:

- 1. Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and
- 2. Rehabilitation of Concrete Structures," Allied Publishers, 2004.
- 3. Gambhir.M.L., "Concrete Technology," McGraw Hill, 2013
- 4. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
- 5. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
- 6. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J.Kibert, New York: John Wiley & Sons, 2012.
- 7. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibertet al, New York: John Wiley & Sons, 2011.

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

CO PO MAPPING

23BECEOE04COMPUTER-AIDED CIVIL ENGINEERING DRAWING3H- 3CInstruction Hours/week: L: 3 T: 0 P: 0Marks: Internal:40External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings
- Communicate a design idea/concept graphically/ visually
- Examine a design critically and with understanding of CAD The student learns to interpret drawings, and to produce designs using a combination of 2D and 3D software.
- Get a Detailed study of an engineering artifact.
- To Communicate a design idea/concept graphically/ visually

COURSE OUTCOMES:

After completing the course, the students will be able to

- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings
- Communicate a design idea/concept graphically/ visually
- Examine a design critically and with understanding of CAD The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
- Get a Detailed study of an engineering artifact
- Planning and designing of structures

UNIT I INTRODUCTION

Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introductionto computer aided drawing, co- ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.

UNIT II SYMBOLS AND SIGN CONVENTIONS

Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards.

UNIT III MASONRY BONDS

English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick wall

UNIT IV BUILDING DRAWING

Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundationplan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity.

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UNIT V: PICTORIAL VIEW

Principles of isometrics and perspective drawing. Perspective view of building, Software's

TEXT BOOKS:

- 1. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt.Ltd.,
- 2. Subhash C Sharma & Gurucharan Singh (2005), "CivilEngineering Drawing", StandardPublishers

REFERENCE BOOKS:

- 1. (Corresponding set of) CAD Software Theory and User Manuals.
- 2. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication LtdNewAsian.
- 3. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria&Sons.
- 4. Ajeet Singh (2002), "Workingwith AUTOCAD 2000 with updates on AUTOCAD 2001", Tata- Mc Graw-Hill Company Limited, NewDelhi

CO PO MAPPING

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

23BECEOE05

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

COURSE OBJECTIVES:

B.E Civil Engineering

To have developed a more detailed appreciation for construction planning and scheduling •

CONTRACTS MANAGEMENT

- To apply their learned knowledge as it pertains to upper-level construction management • skills and procedures.
- To evaluate the best practices associated with the development of contract parameters. •
- To understand the legal aspects of acts governing the contracts
- To discuss techniques for appropriate risks and changes, monitoring and measuring the • contract closure
- To understand the basics of the bid process, important points in a tender document, and • unbalanced contracts.

COURSE OUTCOMES:

After completing the course, the students will be able to

- Apply project Procurement management concepts in a project environment.
- Describe techniques used to procure resources within a project's scope and techniques to reduce procurement risks.
- Evaluate the best practices associated with the development of contract parameters. •
- Understand the legal aspects of acts governing the contracts
- Discuss techniques for appropriate risks and changes, monitoring and measuring the • contract closure
- Understand the basics of the bid process, important points in a tender document, and unbalanced contracts.

UNIT I CONTRACT MANAGEMENT

Introduction, Importance of Contracts, Overview of Contract Management, Overview of Activities in Contract Management; Planning and People- Resource Management; Types of Contracts, Parties to a Contract; Contract Formation, Formulation of Contract, Contract Start-Up, Managing Relationships; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price.

UNIT II CONTRACT PARAMETERS

Performance parameters; Delays, penalties, and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Notices under contracts; Conventional and Alternative Dispute Resolution methods.

UNIT III VARIOUS ACTS GOVERNING CONTRACTS

Contract Administration and Payments- Contract Administration, Payments; Contract Management in Various Situations- Contract Management in NCB Works, Contract Management in ICB Works Contracts, Contract of Supply of Goods- Design, Supply and Installation Contracts, Contract Management in Consultancy,

UNIT IV BID PROCESS AND BID EVALUATION

Bid process, important points in a tender document, and unbalanced contracts. Material covered includes: Request For Proposal and problems Different types of proposals Design Conditions and Standard Component List-Tender document - Unbalanced proposals. Exercises: Evaluating Unit

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

Marks: Internal:40External:60 Total:100

End Semester Exam: 3 Hours

3H-3C

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Prices Premium Portion Of The Overtime Rate Handling Bid Questions.

UNIT V MANAGING RISKS AND CHANGE

Managing Risks, Managing Change; Contract Closure and Review- Ending a Contract, Post-Implementation Review; Legal Aspects in Contract Management- Contract Management Legal View, Dispute Resolution, Integrity in Contract Management; Managing Performance-Introduction, Monitoring and Measurement.

TEXT BOOKS:

- 1. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
- 2. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
- 3. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J.Kibert, New York: John Wiley & Sons, 2012.

REFERENCE BOOKS:

- 1. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibertet al, New York: John Wiley & Sons, 2011.
- 2. Varghese, P.C., "Building Construction," Prentice Hall India, 2007.
- 3. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
- 4. Chudley, R., Construction Technology, ELBS Publishers, 2007.
- 5. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
- 6. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
- 7. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson EducationIndia, 2015
- 8. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

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

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23BECEOE06 AIR AND NOISE POLLUTION AND CONTROL 3H-3C Instruction Hours/week: L: 3 T: 0 P: 0

Marks: Internal:40External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

- To impart knowledge on the principles and design of control of indoor/ particulate / • gaseous air pollutant and its emerging trends
- To induce operational considerations under the processing and control monitoring. •
- To apply sampling techniques of gaseous contaminants. •
- To control noise pollution by specific measurements, standard and preventive • measures.
- To enable to evaluate the behavior of air pollutants.
- To have knowledge about appropriate control measures of air pollution

COURSE OUTCOMES:

After completion of this course, the student will be able to

- Have knowledge about appropriate control measures of air pollution. •
- To apply sampling techniques and suggest suitable air pollution prevention ٠ equipment's and techniques for various gaseous and particulate pollutants.
- Have knowledge about the air pollution monitoring and modeling. •
- Understand causes of air pollution and analyze different types of air pollutants. •
- Evaluate air pollutant behavior in the atmosphere. •
- Enable to evaluate the behavior of air pollutants. •

UNIT I INTRODUCTION

Structure and composition of Atmosphere - Sources and classification of air pollutants - Effects of air pollutants on human health, vegetation & animals, Materials & Structures - Effects of air Pollutants on the atmosphere, Soil & Water bodies - Long- term effects on the planet - Global Climate Change, Ozone Holes - Ambient Air Quality and Emission Standards - Air Pollution Indices-Emission Inventories.

UNIT II AIR POLLUTION MONITORING AND MODELLING

Ambient and Stack Sampling and Analysis of Particulate and Gaseous Pollutants -Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Transport & Dispersion of Air Pollutants - Modeling Techniques - Air PollutionClimatology.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS

Factors affecting Selection of Control Equipment – Gas Particle Interaction, – Working principle, Design and performance equations of Gravity Separators, cyclones, Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations - Process Control and Monitoring -Costing of APC equipment - Case studies for stationary and mobile sources.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations - Costing of APC Equipment – Case studies for stationary and mobile sources.

UNIT V AUTOMOBILE AND NOISE POLLUTION

Vehicular Pollution: Automobile emission- Types of emissions- Exhaust emissions, evaporative emissions, crank-case emissions- Prevention and control of vehicular pollution. Noise Pollution: Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventivemeasures. Source types and control of indoor air pollutants, sick building syndrome types – Radon Pollution and its control.

TEXTBOOKS:

- 1. Anjaneyulu D, "Air pollution and control technologies," Allied Publishers, Mumbai, 2002.
- 2. Khitoliya R K, "Environmental Pollution," 2/e, S. Chand Publishing, 2012.

REFERENCE BOOKS:

- 1. Rao C.S, "Environmental pollution control engineering," Wiley Eastern Ltd., New Delhi,1996.
- 2. Rao M.N, and Rao H.V.N, "Air Pollution Control" Tata-McGraw-Hill, New Delhi, 1996.
- 3. David H. F Liu, Bela G.Liptak, "Air Pollution," Lewis Publishers, 2000.
- 4. Mudakavi, J R, "Principles and Practices of Air Pollution Control and Analysis" IK International, 2010.
- 5. Air Pollution act, India, 1998.

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	2	1	2	1	-	2	-	2	2	-	-
CO2	3	2	-	2	1	2	1	-	2	-	2	2	-	-
CO3	3	2	-	2	1	2	1	-	2	-	2	2	-	-
CO4	3	2	-	2	1	2	1	-	2	-	2	2	-	-
C05	3	2	-	2	1	2	1	-	2	-	2	2	-	-
Avg	3	2	I	2	1	2	1	-	2	-	2	2	-	-

CO PO MAPPING

B.E. COMPUTER SCIENCE ENGINEERING

23BECSOE01

INTERNET OF THINGS

3H-3C

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

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

COURSE OBJECTIVES:

The goal of this course is for the students to

- Understand the basics of Internet of Things.
- Identify an idea of some of the application areas where Internet of Things can be applied.
- Infer the middleware for Internet of Things.
- Express the concepts of Web of Things .
- Examine the concepts of Cloud of Things with emphasis on Mobile cloud computing.
- Inspect the IOT security protocols.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Model IoT architecture for a given application.
- Identify the feasibility and potential impact of IoT solutions in different industries.
- Apply a systematic and structured approach to designing IoT solutions.
- Make use of techniques to secure the elements of an IoT device.
- Utilize security protocols in IOT domains of industrial applications.

UNIT I INTRODUCTION TO IoT

Introduction to IoT – IoT Architectures – Core IoT Functional Stack, Sensors and Actuators Layer, Communications Network Layer, Applications and Analytics Layer – IoT Data Management and Compute Stack, Fog Computing, Edge Computing, Cloud Computing – Sensors, Actuators, Smart Objects, Sensor networks. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security, WSN and Sensing Model.

UNIT II IoT COMMUNICATION

Communications Criteria – Access Technologies – IP as IoT Network Layer – Business case – Optimization – Profiles and compliances – Application Protocols – Transport Layer – Application Transport Methods.

UNIT III DESIGN METHODOLOGY

Design Methodology – Case study – Basic blocks of IoT device – Raspberry Pi – Board, Interfaces, Linux, Setting up, Programming – Arduino – Other IoT Devices.

UNIT IV DATA ANALYTICS FOR IoT

Data Analytics for IoT – Big Data Analytics Tools and Technology – Edge Streaming Analytics – Network Analytics Applications. Security history, challenges, variations – Risk Analysis Structures – Application in Operational Environment.

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UNIT V IoT IN INDUSTRY

Manufacturing, Architecture, Security Protocols – Utilities, Grid Blocks - Smart Cities, Architecture, use cases – Transportation, Architecture, Use cases.

TOTAL: 45

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TEXT BOOKS:

- 1. Honbo Zhou "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2013
- 2. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer Berlin, 2011
- 3. David Easley, Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010

REFERENCE BOOKS:

- 1. Olivier Hersent, Omar Elloumi and David Boswarthick,"The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2018
- 2. Olivier Hersent, David Boswarthick, Omar Elloumi,"The Internet of Things Key applications and Protocols", Wiley, 2019

WEBLINKS:

- 1. https://www.javatpoint.com/iot-internet-of-things
- 2. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/
- 3. https://www.tutorialspoint.com/internet_of_things/index.htm
- 4. https://www.startertutorials.com/blog/physical-design-of-iot.html
- 5. <u>https://www.guru99.com/iot-tutorial.html</u>

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	2	-	2	2	-	-
CO2	3	3	2	2	2	-	-	-	2	-	2	2	-	-
CO3	3	3	2	2	2	-	-	-	2	-	2	2	-	-
CO4	3	2	2	2	-	-	-	-	2	-	2	2	-	-
CO5	3	2	2	2	2	-	-	-	2	-	2	2	-	•
Avg.	3	2	2	2	2	-	-	-	2	-	2	2	-	-

CO PO MAPPING

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

B.E. COMPUTER SCIENCE ENGINEERING

23BECSOE02

COURSE OBJECTIVES

The goal of this course is for the students to

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

- Introduce the basic concepts and techniques of Machine Learning.
- Understand Supervised and Unsupervised learning techniques.
- Study the various probability-based learning techniques.
- Learn Dimensionality Reduction Techniques.
- Infer Evolutionary Models and Graphical models of machine learning algorithms.

MACHINE LEARNING

COURSE OUTCOMES

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

- Apply machine learning concepts to dimensionality reduction.
- Construct machine learning techniques for a given problem.
- Experiment with open-source machine learning libraries and its uses.
- Choose similarity based learning for predictive data analytics.
- Identify online fraud detection to diagonise sensitive information.

UNIT I: MACHINE LEARNING BASICS

Introduction to Machine Learning (ML) - Essential concepts of ML – Types of learning – Machine learning methods based on Time – Dimensionality – Linearity and Non linearity – Early trends in Machine learning – Data Understanding Representation and visualization.

UNIT II: MACHINE LEARNING METHODS

Linear methods – Regression -Classification –Perceptron and Neural networks – Decision trees – Support vector machines – Probabilistic models —Unsupervised learning – Featurization

UNIT III: MACHINE LEARNING IN PRACTICE

Ranking – Recommendation System - Designing and Tuning model pipelines- Performance measurement – Azure Machine Learning – Open-source Machine Learning libraries – Amazon's Machine Learning Tool Kit: Sagemaker

UNIT IV: MACHINE LEARNING AND DATA ANALYTICS

Machine Learning for Predictive Data Analytics – Data to Insights to Decisions – Data Exploration – Information based Learning – Similarity based learning – Probability based learning – Error based learning – Evaluation – The art of Machine learning to Predictive Data Analytics.

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End Semester Exam:3 Hours

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2023-2024

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

UNIT V: APPLICATIONS OF MACHINE LEARNING

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Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis.

TOTAL: 45

TEXT BOOKS:

- 1. Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer Publications, 2020
- 2. John D. Kelleher, Brain Mac Namee, Aoife D' Arcy, Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies, MIT press,2015

REFERENCES:

- 1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer Publications, 2011
- 2. Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial Intelligence: A Modern Approach, Prentice Hall, 2020 3. Machine Learning Dummies, John Paul Muller, Luca Massaron, Wiley Publications, 2021

WEBLINKS:

- 1. <u>https://www.tutorialspoint.com/machine_learning/index.htm</u>
- 2. <u>https://www.hackerearth.com/practice/machine-learning/challenges-winning-approach/machine-learning-challenge-one/tutorial/</u>
- 3. https://www.javatpoint.com/machine-learning
- 4. https://www.geeksforgeeks.org/machine-learning/

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

CO PO MAPPING

B.E COMPUTER SCIENCE ENGINEERING

23BECSOE03 BLOCKCHAIN TECHNOLOGIES 3H-3C

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

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

COURSE OBJECTIVES:

The goal of this course is for the students to

- Comprehend the importance of the Blockchain framework and its practical uses.
- Scrutinize the verification of Bitcoin transactions through the utilization of the Blockchain.
- Recognize the constituent elements of smart contracts required for achieving consensus in a Permissioned Blockchain.
- Furnish the essential infrastructure and boost the effectiveness, efficacy, and transactions of diverse business procedures by utilizing Hyperledger.
- Examine the scope of utilization of Blockchain in diverse governmental and nongovernmental entities.

COURSE OUTCOMES:

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

- Model blockchain architecture for an application.
- Apply proof of work consensus algorithm in securing the network.
- Build permissioned blockchain to assest transfer.
- Identify the transaction flow in Hyperledger Fabric and validation processes.
- Analyze message digest hashing algorithms in blockchain technology.

UNIT I INTRODUCTION

Introduction – Block Structure – Architecture – Block Header – Genesis Block – Merkle Trees – Hashing - Signature & Encryption Schemes – Business Applications

UNIT II BITCOIN BASICS

Bitcoin Basics – Wallet - Decentralized Consensus – Aggregate transactions - Proof of Work – Miners – Consensus Algorithms – Double Spending - Verifying Transactions – Fork – Reward

UNIT III PERMISSIONED BLOCK CHAIN

Permissioned Block Chain – Smart Contracts - Consensus – Raft – Byzantine – Paxos – Degree of Decentralization – Asset Transfer - Enterprise Application

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UNIT IV FABRIC ARCHITECTURE

Fabric Architecture – Transaction Flow – Channel – Ordering Service –Membership & Identity Management – Network Setup – Hyperledger Composer – Roles – Network Administration

UNIT V BLOCKCHAIN USE CASES & SECURITY

Financial Services – Supply Chain – Government – Digital Identities – Land Record Registry – Security Overview – Membership & Access Control – Privacy

TEXT BOOKS:

- 1. Andreas M. Antonopoulos, "Mastering Bitcoin", 2nd Edition, O'Reilly Media, 2017
- 2. Melanie Swan, "Blockchain: Blueprint for a New Economy", 1st Edition, O'Reilly Media, 2017

REFERENCE BOOKS:

- 1. Nitin Gaur, Luc Desrosiers, Et al, "Hands-On Blockchain with Hyperledger", Packt Publisher, June 2018
- 2. Imran Bashir, "Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks", Packt Publisher, March 2017

WEBLINKS:

- 1. https://nptel.ac.in/courses/106105184
- 2. https://www.hyperledger.org/projects/fabric
- 3. https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html
- 4. https://www.javatpoint.com/blockchain-tutorial

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

CO PO MAPPING

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TOTAL: 45

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B.E COMPUTER SCIENCE ENGINEERING

23BECSOE04

COURSE OBJECTIVES:

The goal of this course is for the students to:

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

- Learn the basic concepts of cloud computing.
- Learn types of cloud services and its applications.
- Understand the key components of Amazon Web Services.
- Collaborate with real time cloud services.
- Understand the security risk and application of cloud computing.

COURSE OUTCOMES:

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

- Identify the basic concepts of cloud computing and its usage.
- Choose cloud computing services based on infrastructure providers.
- Utilize the ways of collaborating cloud with web based communication tools.. •
- Build load balancing techniques using virtualization techniques. •
- Develop proficiency in Google web services for cloud management.

UNIT I CLOUD INTRODUCTION

Cloud Computing Fundamentals: Cloud Computing definition, Types of cloud, Cloud services: Benefits and challenges of cloud computing, Evolution of Cloud Computing, usage scenarios and Applications, Business models around Cloud - Major Players in Cloud Computing - Issues in Cloud -Eucalyptus - Nimbus - Open Nebula, Cloud Sim.

CLOUD COMPUTING

UNIT II CLOUD SERVICES AND FILE SYSTEM

Types of Cloud services: Software as a Service - Platform as a Service - Infrastructure as a Service -Database as a Service - Monitoring as a Service - Communication as services. Service providers -Google App Engine, Amazon EC2, Microsoft Azure, Sales force. Introduction to MapReduce, GFS, HDFS, Hadoop Framework.

UNIT III COLLABORATING WITH CLOUD

Collaborating on Calendars, Schedules and Task Management – Collaborating on Event Management, Contact Management, Project Management - Collaborating on Word Processing, Databases - Storing and Sharing Files- Collaborating via Web-Based Communication Tools - Evaluating Web Mail Services – Collaborating via Social Networks – Collaborating via Blogs and Wikis.

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2023-2024

End Semester Exam:3 Hours

Marks: Internal:40 External:60 Total:100

UNIT IV ABSTRACTION AND VIRTUALIZATION

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.

UNIT V MANAGING AND SECURING CLOUD

Managing & Securing the Cloud: Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, Establishing Identity and Presence. Case-Studies: Using Google Web Services, Using Amazon Web Services, Using Microsoft Cloud Services

TEXT BOOKS:

- 1. John Ritting house & James Ransome, "Cloud Computing Implementation Management and Strategy", CRC Press, 2018.
- 2. Rao M.N., Cloud Computing, PHI Learning Private Limited, 2018.

REFERENCES:

- 1. Bloor R., Kanfman M., Halper F. Judith Hurwitz "Cloud Computing for Dummies" (Wiley India Edition), 2015.
- 2. Antohy T Velte, Cloud Computing: "A Practical Approach", McGraw Hill, 2018.

WEBLINKS:

- 1. https://nptel.ac.in/courses/106105167/
- 2. <u>https://www.javatpoint.com/cloud-computing</u>

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

CO PO MAPPING

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TOTAL: 45

23BECYOE01BASICS OF CYBER CRIME AND CYBER SECURITY3H-3CInstruction Hours/week: L:3 T:0 P:0Marks: Internal:40 External:60 Total:100
End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

- Uunderstand the fundamental concepts of cybercrime.
- Explore knowledge on cybercrimes in wireless devices.
- Infer tools used in the cyber security.
- Familiar with various Indian IT Act in cybercrime and cyber security.
- Enhance the knowledge in handheld devices and digital forensics.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Identify the basics of cyber-crime and information security in safeguarding digital assets.
- Apply the fundamentals concepts for identifying cyber-attacks.
- Make use of tools and methods used in cyber security.
- Analyze theoretical and cross-disciplinary approaches in Indian IT Act and in digital devices.
- Discover the effect of cybercrime on digital devices on the public sector, private sector, individual, and societal levels.

UNIT I INTRODUCTION

Introduction to Cyber Crime: Cyber Crime and Information Security – Classifications of Cyber Criminals – Cyber Cri\me Legal Perspective and Indian Perspective – Cyber Crime and Indian ITA – A Global perspective on Cybercrimes – Categories of Cybercrimes – Criminal plans for attack – Social Engineering – Cyber talking – Cyber cafe and cyber criminals – Botnet – Attack vector – Cloud Computing.

UNIT II CYBER CRIME MOBILE AND WIRELESS DEVICES

Cyber Crime Mobile and Wireless Devices: Proliferation – Trends in Mobility – Credit card frauds – Security challenges – Registry setting – Authentication service – Attacks – Security Implication for Organization – Organizational measures – Organizational Security Policies – Physical security counter measures.

UNIT III TOOLS AND METHODS USED IN CYBER SECURITY

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

2023-2024

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UNIT IV CYBER CRIME AND LEGAL LANDSCAPE

Cyber Crime and Legal landscape – Indian IT Act – Digital Signature and Indian IT Act – Amendments to the Indian IT Act – Cybercrime and punishment. Understanding Computer Forensics: Need for computer forensics – Cyber forensics and digital evidence – Digital forensics life cycle – Network forensics – Computer forensics and steganography - Computer forensics from compliance perspective – Challenges

UNIT V SPECIAL TOOLS AND TECHNIQUES

Special tools and techniques –Hand held devices and digital forensics. Cyber security organizational implications: Cost of cybercrimes and IPR – Web threads for organizations – Security and privacy implications – Social media marketing – Incident handling – Forensics best practices for organization.

TEXT BOOKS:

1. Nina Godbole and Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley Publisher, First Edition, 2011

REFERENCE BOOKS:

- 1. Harish Chander, Cyber Laws and IT Protection, PHI Learning, First Edition, 2012
- 2. James Graham, Ryan Olson and Rick Howard, Cyber Security Essentials, CRC Press, First Edition, CRC Press, First Edition

WEBLINKS:

- 1. www.lexology.com/library/
- 2. www.swayam.gov.in/nd2_ugc19_hs25/preview
- 3. www.educba.com/cyber-security-tools/
- 4. www.intaforensics.com
- 5. www.itu.int/en/ITU-D/Cybersecurity

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

CO PO MAPPING

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TOTAL: 45

B.E COMPUTER SCIENCE ENGINEERING (CYBER SECURITY)

23BECYOE02BASICS OF CYBER FORENSICS3H-3CInstruction Hours/week:L:3 T:0 P:0Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

- Make aware of fundamentals on cyber forensics and usage of cyber forensics tools.
- Be familiar with the file systems and challenges in the Linux and mac operating system.
- Explore knowledge on the network and different operating systems on mobile devices.
- Learn various services like FaaS and MaaS.
- Enhance the knowledge on database, email and threats in crypto currency.

COURSE OUTCOMES:

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

- Identify the basic of Forensics investigation process.
- Utilize popular Linux distributions used for forensic analysis, file systems, processes, and artifacts associated with Linux systems.
- Make use of iOS forensics and relevant data extraction procedure from iOS devices
- Analyze the challenges in cloud forensics.
- Discover Bitcoin forensics and Blockchain artifacts.

UNIT INTRODUCTION

Introduction to Cyber forensics: Forensics investigation process – Forensics protocol – Digital forensics standards –Digital evidence – Types of cybercrime – Notable data breaches – Case study - Challenges in Cyber security – Cyber forensics tools. Windows forensics: Digital Evidence – File systems – Time analysis – Challenges- Case Study.

UNIT II LINUX FORENSICS AND MAC OS FORENSICS

Linux forensics: Popular linux – File systems – Process – Artifacts – Linux distribution used for forensics analysis – Challenges – Case study. Mac OS forensics: File systems – Process – Artifacts – Information to collect Mac book forensics investigation – Case study. Anti-forensics: Data wiping and shredding – Trial obfuscation – Encryption – Data hiding – Anti-forensics detection technique

UNIT III NETWORK FORENSICS AND MOBILE FORENSICS

Network forensics: OSI Model – Artifacts – ICPM Attack – Analysis tools. Mobile forensics: Android operating system – Mutual Extraction – Physical acquisition – Chip-off – Micro-read – Challenges – iOS operating system.

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UNIT IV CLOUD FORENSICS AND WEB ATTACK FORENSICS

Cloud forensics: Cloud computing model – Server-side forensics – Client-side forensics – Challenges –Artifacts – use – Forensics as a Service. Malware forensics: Types – Analysis – Tools – Challenges – Malware as a Service. Web attack forensics: Web attack test – Intrusion forensics – Database forensics – Log forensics – Content analysis – File metadata forensics

UNIT V EMAILS AND EMAIL CRIMINALS

Emails and email criminals: Protocols – Email criminals – Email forensics. Solid State device forensics: Components –Data wiping – Analysis. Bit coin forensics: Crypto currency – Block chain – Artifacts – Challenges.

TOTAL: 45

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TEXT BOOKS:

1. Niranjan Reddy, Practical Cyber Forensics: An Incident-Based Approach to Forensic Investigations, Apress, First Edition, 2019

REFERENCE BOOKS:

- 1. Marjie Britz T, Computer Forensics and Cyber Crime: An Introduction, Prentice Hall, ThirdEdition, 2013
- 2. Albert Marcella J and Frederic Guillossou, Cyber Forensics: From Data to Digital Evidence, Wiley Publisher, .First Edition, 2012

WEBLINKS:

- 1. www.swayam.gov.in/nd2_ugc19_hs25/preview
- 2. www.educba.com/cyber-security-tools/
- 3. www.intaforensics.com
- 4. www.cs.nmt.edu/~df/lectures.html

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

CO PO MAPPING

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23BECYOE03CYBER LAWS AND INTELLECTUAL PROPERTY RIGHTS3H-3CInstruction Hours/week: L:3 T:0 P:0Marks: Internal:40 External:60 Total:100End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

- Understand the need for cyber laws and intellectual property rights.
- Acquire knowledge about the protective measures of Intellectual property such as copyright, patent, Trademark.
- Examine the criminal remedies and defensive measures.
- Provide an insight about the role of certifying authority and cryptography.
- Be aware of Indian IT Act 2000 and 2008 cyber laws.

COURSE OUTCOMES:

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

- Identify the fundamental concepts of cyber laws and the various intellectual property rights for criminal activities.
- Utilize the concept of work of employment and its implications in copyright infringement cases.
- Select civil remedies available for design infringement and their application in different infringement scenarios.
- Identify the scope and significance of cyber laws that arises from the use of technology.
- Make use of information technology act and its subsequent amendments in cyberspace.

UNIT I INTRODUCTION

Intellectual Property: Introduction – Protection of Intellectual Property – Copyright related rights – Patents – Industrial designs – Trademark – Unfair competition – Information technology related intellectual property rights – Computer software and intellectual property – Copyright protection – Reproducing – Defences – Patent protection.

UNIT II INFRINGEMENT

Ownership and enforcement of intellectual property – Defences in case of infringement copyright – Work of employment infringement – Defences for infringement – Trademarks – Rights – Protection of good will – Infringement – Passing off defences.

UNIT III IP IINTELLECTUAL PROPERTY RIGHTS AND ENFORCEMENT 9

Designs – Defences of design infringement. Enforcement of intellectual property rights – Civil remedies – Criminal remedies – Border – Security measures. Practical aspects of licensing – Benefits

- Determinative factors - Important clauses - Licensing clauses.

UNIT IV CYBER LAW

Cyber law: Basic concepts of technology and law – Understanding the technology of internet – Scope of cyber laws. Cyber jurisprudence law of digital contracts: The essence of digital contracts – The system of digital signatures – The role and function of certifying authorities

UNIT V INTELLECTUAL PROPERTY ISSUES

The science of cryptography – IT Act 2000 and 2008 – Amendments in IT Act – IPC and Privacy threats in cyber law. Intellectual Property issues in cyber space: Domain names and related issues – Copyright in the digital media – Patents in the cyber world. rights of netizens and e-Governance.

TEXT BOOKS:

1. David I Bainbridge, Intellectual Property, Pearson Education, Eighth Edition, 2010

2. Talat Fatima, Cyber Law in India, Wolters Kluwer, First Edition, 2017

REFERENCE BOOKS:

- 1. Yatindra Singh, Guide to Cyber Laws, Universal Law, Fourth Edition, 2010
- 2. Information Technology Law and Practice- Cyber Laws and Laws Relating to E-Commerce, Universal Law, Third Edition, 2011

WEBLINKS:

- 1. www.core.ac.uk/download/pdf/144527187.pdf
- 2. www.nptel.ac.in/courses/110/105/110105139/
- 3 www.icsi.edu/media/webmodules/FINAL_IPR&LP_BOOK_10022020.pdf
- 4 www.lawshelf.com/videocoursesmoduleview/
- 5 www.lawfaculty.du.ac.in/files/course_material/Old_Course_Material/

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

CO PO MAPPING

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

TOTAL : 45

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2023-2024

23BECYOE04 BLOCKCHAIN AND CYBER SECURITY

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

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

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COURSE OBJECTIVES:

The goal of this course is for the students to

- Decompose a block chain system's fundamental components, how they fit together and examine a decentralization using block chain.
- Illustrate how Crypto currency works, from when a transaction is created to when it is considered part of the blockchain.
- Explain the components of Ethereum, programming languages for Ethereum and study the basics Hyperledger and Web3.
- Understand the nature of threats and cyber security management goals and technology
- Infer the landscape of hacking and perimeter defense mechanisms

COURSE OUTCOMES:

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

- Identify the technology components of Block chain and its working principles.
- Utlize Ethereum model and its architectural components.
- Make use of Hyperledger components along with its development framework.
- Categorize the nature of threats and cyber security management goals.
- Discover malicious software attack and wireless network attack.

UNIT I INTRODUCTION OF BLOCKCHAIN TECHNOLOGY

History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization. Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Theoretical Limitations – Bitcoin Limitations – Name Coin – Prime Coin – Zcash. – Smart Contracts – Ricardian Contracts.

UNIT II ETHEREUM NETWORK

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.

UNIT III FRAMEWORK FOR HYPERLEDGER FABRIC

Introduction to Web3 – Contract Deployment – POST Requests – Development frameworks – Hyperledger as a protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda-Alternative Blockchains.

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UNIT IV CYBER SECURITY

Introduction – Cyberspace – Cyber Crime – Nature of Threat – Cyber security – Policy, Mission and Vision of Cyber security Program. Cyber security management system – goals, technology categories –perimeter defense and encryption.

UNIT V WEB APPLICATION ATTACKS

Malicious Attacks, Threats, and Vulnerabilities- Malware –malicious software attack – social engineering attack – wireless network attack – web application attack –Countermeasures. Creating Mechanisms for IT Security.

TEXT BOOKS:

- 1. Imran Bashir "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained" Packt Publishing, Second Edition 2018.
- 2. Arshdeep Bahga, Vijay Madisetti "Blockchain Applications: A Hands-On Approach" VPT Publications, First Edition 2017.
- 3. David Kim and Michael G. Solomon "Fundamentals of Information Systems Security" Jones &Bartl Learning, Third Edition 2018.
- 4. Peter Trim and Yang –Im Lee "Cyber Security Management- A Governance, Risk and Compliance Framework" Gower Publishing, First Edition 2014.

REFERENCE BOOKS:

- 1. Andreas Antonopoulos, Satoshi Nakamoto "Mastering Bitcoin", O'Reilly Publishing, Second Edition 2017.
- 2. Alex Leverington "Ethereum Programming", Packt Publishing, First Edition 2017.
- 3. John G. Voeller "Cyber Security" John Wiley & Sons, First Edition 2014.

WEB SITES:

- 1. www.nptel.ac.in/courses/106/104/106104220/
- 2. www.icaew.com/technical/technology/blockchain/blockchain-articles/whatisblockchain/history
- 3. www.ibm.com/topics/blockchain-security
- 4. https://blockgeeks.com/guides/ethereum/
- 5. <u>https://world101.cfr.org/global-era-issues/cyberspace-and-cybersecurity/what-are-cyberspaceand-cybersecurity</u>

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TOTAL: 45

CO PO MAPPING

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

B. Tech ARTIFICIAL INTELLIGENCE & DATA SCIENCE

23BTADOE01

FUNDAMENTALS OF DATA SCIENCE

3H-3C

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

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

COURSE OBJECTIVES:

The goal of this course is for the students to

- Study the basic concepts of Data Science and data life cycle
- Understand the theoretical and mathematical aspects of Data Science models
- Learn common random variables and their uses, and with the use of empirical distributions
- Obtain the knowledge in data management tools
- Explore the major techniques for data science

COURSE OUTCOMES:

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

- Identify the key concepts in data science and data processing.
- Apply sampling and probabilistic models to a real time application.
- Make use of data normalization and data management tools.
- Distinguish between supervised and unsupervised machine learning techniques.
- Inspect different analytics used in business intelligence.

UNIT I INTRODUCTION

The Big Picture: What is Data Science? –The data life cycle: pre-processing, analysis, post-processing – Pre-processing: Data gathering, cleansing, visualization, and understanding (Mean, Variance, Standard Deviation. Percentiles.)–Data Storage (Relational databases, e.g. MySQL)

UNIT II PROBABILISTIC MODELS

Sampling – Probability Models for Statistical Methods: Discrete and continuous probability distributions, density functions. Random variables, expected values, variance, correlation.

UNIT III NORMALIZATION

Data Normalization (z-values, transforms) -Random processes -Data Management: Tools for Data

Analysis, Case Study: Data analysis using Python-Arrays, Visualization.

UNIT IV DATA MINING

Major Techniques in Data Science: Data mining, Data warehousing, Data mining vs Data warehouse– Machine Learning- Supervised Learning, Unsupervised Learning.

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UNIT V BUSINESS INTELLIGENCE AND ANALYTICS

Business Intelligence –Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics– Cloud computing-definition, Cloud services, types of clouds, some of commercial and non-commercial cloud service providers.

TEXT BOOKS:

 Glenn J. Myatt, Wayne P. Johnson, Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, John Wiley & Son Publication, Second Edition, 2014.
Saltz Jeffrey S, An Introduction to Data Science, Sage Publications Inc, Second Edition, 2019.

REFERENCE BOOKS:

1.Murtaza Haider, Getting Started with Data Science: Making Sense of Data with Analytics, IBM Press, First Edition, 2015.

2. Peter Bruce & Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly Publication, First Edition, 2017.

WEBLINKS:

- 1. https://www.inferentialthinking.com/chapters/intro
- 2. https://swayam.gov.in/nd1_noc20_cs36/preview
- 3. https://swayam.gov.in/nd1_noc19_cs60/preview
- 4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/

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

CO- PO Mapping

TOTAL: 45

B. Tech ARTIFICIAL INTELLIGENCE & DATA SCIENCE

23BTADOE02 FUNDAMENTALS OFARTIFICIAL INTELLIGENCE 3H-3C

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

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

COURSE OBJECTIVES:

The goal of this course is for the students to

- Understand the various characteristics of Intelligent agents
- Learn the different search strategies in AI
- Represent knowledge in solving AI problems.
- Illustrate the different ways of designing software agents
- Know the various applications of AI.

COURSE OUTCOME:

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

- Apply search algorithms in real world scenarios.
- Identify different methods of knowledge representation.
- Examine description logic and conceptional dependencies.
- Inspect strategies for optimal decision-making in the context of game-playing scenarios.
- Categorize the properties of Markov process and the concept of transition probabilities.

UNIT I INTRODUCTION

Introduction: Objective, scope and outcome of the course Meaning and definition of artificial intelligence, Physical Symbol System Hypothesis, production systems, Characteristics of production systems; Breadth first search and depth first search techniques. Heuristic search Techniques: Hill Climbing, Iterative deepening DFS, bidirectional search. Analysis of search methods. A* algorithm, and their analysis. Introduction to Genetic Algorithms.

UNIT II KNOWLEDGE REPRESENTATION

Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, logical consequences, syntax and semantics of an expression, semantic Tableau. Forward and backward reasoning. Proof methods, substitution and unification, conversion to clausal form, normal forms, resolution, refutation, deduction, theorem proving, inferencing, monotonic and non-monotonic reasoning. Introduction to prolog.

UNIT III NETWORK-BASED REPRESENTATION

Network-based representation and reasoning, Semantic networks, Conceptual Graphs, frames. Description logic (DL), concept language, reasoning using DL. Conceptual dependencies (CD), pts, reasoning using CD. Introduction to natural language processing.

236

2023-2024

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UNIT IV GAME THEORY

Adversarial search and Game theory, classification of games, game playing strategies, prisoner's Dilemma. Game playing techniques, minimax procedure, alpha-beta cut-offs. Complexity of alphabeta search. Automated planning, classical planning problem, forward planning, partial order planning, planning with proposal logic, hierarchical task planning, multiagent planning.

UNIT V FUZZY LOGIC

Reasoning in uncertain environments, Fuzzy logic, fuzzy composition relation, operations on fuzzy sets. Probabilistic reasoning, Bayes theorem, construction of Bayesian networks, belief propagation. Markov processes and Hidden Markov models.

TEXTBOOKS

- 1. "Artificial Intelligence", Elaine Rich, Kevin Knight, Mc-GrawHill, 2020.
- 2. "Introduction to AI & Expert System", Dan W. Patterson, PHI,2020.

REFERENCE BOOKS:

- 1. "Artificial Intelligence" by Luger (Pearson Education),2020.
- 2. Russel Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2020.

WEBLINKS:

1. https://www.pluralsight.com/blog/data-professional/fundamentals-of-artificial-intelligence

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

CO PO MAPPING

TOTAL:

45

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• Recall fundamental tags used in HTML5 and CSS to create simple web application.

• Rephrase the concept to create static and dynamic webpage with validation controls and event handling methods.

INTERNET PROGRAMMING

- Make use of servlets and JSP tag to develop server-side scripting.
- Summarize the tags in PHP and XML to create simple php web application.
- Interview the basic concept and tags are used in web service application using ajax.

COURSE OUTCOMES:

23BTADOE03

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

The goal of this course is for the students to

COURSE OBJECTIVES:

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

- Develop a basic website using HTML and Cascading Style Sheets.
- Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
- Experiment with server-side programs using Servlets and JSP.
- Model a simple web pages in PHP and represent data in XML format.
- Develop simple web service application using Ajax.

UNIT I - WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0

Web Essentials: Clients, Servers and Communication - The Internet - Basic Internet protocols -World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers - HTML5 - Tables - Lists - Image - HTML5 control elements - Semantic elements - Dragand Drop - Audio - Video controls - CSS3 - Inline, embedded and external style sheets - Rule cascading -Inheritance - Backgrounds - Border Images - Colors - Shadows - Text - Transformations -Transitions – Animations.

UNIT II - CLIENT-SIDE PROGRAMMING

Java Script: An introduction to JavaScript-JavaScript DOM Model-Date and Objects, -Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

UNIT III – SERVER-SIDE PROGRAMMING

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example – JSP: Understanding

B. Tech ARTIFICIAL INTELLIGENCE & DATA SCIENCE

2023-2024

3H-3C

End Semester Exam: 3Hours

Marks: Internal: 40 External:60 Total:100

Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code

UNIT IV – PHP AND XML

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation-Regular Expressions – File handling – Cookies – Connecting to Database. XML: BasicXML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

UNIT V – INTRODUCTION TO AJAX AND WEB SERVICES

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services(WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.

TOTAL: 45

TEXT BOOKS:

- 1. Anuratha A Puntembekar," Internet Programming", Technical Publication, 2020.
- 2. John Dean, "Web Programming with HTML5, CSS and JavaScript", Jones & Part leftLearning, 2018.
- 3. Sriram K Vasudevan, Meenakshi Sundaram, and Chandni Suresh" Essential of InternetProgramming" DreamTech Press, Willey, 2015.

REFERENCE BOOKS:

- 1. Abiket Nagane," Internet Programming II", Nirali Prakashan, 2016.
- 2. Max Bramer,"Web Programming With PHP and MySQL", A Practical guide, Springer, 2015
- 3. Gopalan N.P. and Akilandeswari J., —Web Technologyl, Prentice Hall of India, 2011.
- 4. UttamK.Roy, —Web Technologies^I, Oxford University Press, 2011.

WEBLINKS:

- 1. https://www.geeksforgeeks.org/internet-and-web-programming/
- 2. http://www.eie.polyu.edu.hk/~em/it0506pdf/4%20Internet%20Programming.pdf
- 3. https://www.techopedia.com/definition/23898/web-programming
- 4. https://www.tutorialspoint.com/internet_technologies/index.htm

CO PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	1	-	1	-	-
CO2	3	2	1	-	-	-	-	-	1	1	-	1	-	-
CO3	3	2	1	-	-	-	-	-	1	1	-	1	-	-
CO4	3	2	1	-	-	-	-	-	1	1	-	1	-	-
C05	3	2	1	-	-	-	-	-	1	1	-	1	-	-
Avg.	3	2	1	-	-	-	-	-	1	1	-	1	-	-

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B. Tech ARTIFICIAL INTELLIGENCE & DATA SCIENCE

23BTADOE04

ROBOTICS AND AUTOMATION Marks: Internal: 40 External:60 Total:100

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

End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To introduce the functional elements of Robotics.
- To impart knowledge on the forward and inverse kinematics.
- To interpret the manipulator differential motion and control.
- To educate on various path planning techniques.
- To understand about hydraulics system.

COURSE OUTCOMES:

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

- Apply basic concept of robotics fundamental principles, components, and applications of robotic systems.
- Discuss the dynamics of robotic systems and implications for planning and control. •
- Outline the principles of state estimation, prediction, and update steps involved in the • Kalman filtering process.
- Analyze the components, working principles, and applications of Pneumatic and Hydraulic • system.
- Model the principles of fluidic devices and fluidic logic circuits and their applications in automation.

UNIT I KINEMATICS CONCEPTS

Introduction - Actuators - Sensors - Rigid body - coordinate systems - Kinematics - Forward Kinematics & Inverse Kinematics - Velocity Kinematics - Angular velocity - Linear velocity -Singularity – Force and torque.

UNIT II MOBILE ROBOTS

Dynamics - Mobile Robots - Planning and Control - Path & Trajectory planning - Probabilistic Roadmaps - Localization.

UNIT III PROBABILISTIC METHODS FOR ROBOTICS

Basics of probability - Kalman Filtering - Extended Kalman - Particle filter - Localization -Computer Vision – Vision Based Controls.

UNIT IV AUTOMATION FUNDAMENTALS AND PRINCIPLES

Automation – Basic Laws and Principles – Basic Pneumatic and Hydraulic system – Pumps and compressors - Fluid accessories.

3H-3C

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UNIT V ELECTRICAL AND ELECTRONIC CONTROLS

Cylinders and Motors – Control valves – Circuits – Pneumatic logic circuits – Fluidics – Electrical and electronic controls – Transfer devices and Feeders.

TEXT BOOKS:

- 1. "Robot Modeling and Control", Mark W.Spong,Seth Hutchinson and Vidyasagar. M, Wiley Publishers, Second Edition, 2020.
- 2. "Robot Building for Beginners", David Cook, Apress Publishers, Third Edition, 2015.

REFERENCE BOOKS:

- 1. "Industrial Automation and Robotics", Gupta. A.K and S.K Arora, University Science Press, Third Edition, 2013.
- 2. "Industrial Robotics", Groover. M.P., Weiss. M, Nageland. R.N and Odrej. N.G, Tata McGraw Hill, Singapore, Second Edition, 2017.
- 3. "Embedded Systems & Robotics", Ghoshal. S, Cengage Learning, First Edition, 2009.
- 4. "Introduction to Robotics Mechanics and Control", John J.Craig, Pearson Education, Third Edition, 2009.

WEBLINKS:

- 1. www.nptel.ac.in/courses/112/101/112101099/
- 2. www.nptel.ac.in/courses/112/101/112101098/
- 3. www.toptal.com/robotics/programming-a-robot-an-introductory-tutorial
- 4. www.cyberbotics.com/doc/guide/tutorial-1-your-first-simulation-in-webots
- 5. www.ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/

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

CO PO MAPPING

TOTAL: 45

B.E Electrical and Electronics Engineering

23BEEEOE01

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

Course Objectives

The goal of this course is for students:

- To gain the knowledge about environmental aspects of energy utilization.
- To understand the basic principles of solar cells, photovoltaic conversion.
- To understand the basic principles of wind energy conversion.
- To gain the knowledge about hydro and ocean energy.
- To understand the basic principles of Biomass, fuel cell, Geo-thermal power plants and MHD.

RENEWABLE ENERGY SYSTEMS

Course Outcomes

Upon completion of this course, students will be able:

- Outline the environmental issues associated with fossil fuels and other energy resources.
- Make use of Solar PV systems for practical applications.
- Choose the Wind Turbine systems for application based on their working.
- Explain the operation of Hydroelectric Plant and Ocean Energy
- Compare the working of Biomass Power Generation, Fuel Cell, Geo thermal plants and MHD.

UNIT I INTRODUCTION

Energy scenario - Different types of Renewable Energy Sources – Environmental aspects of energy utilization - Energy Conservation and Energy Efficiency - Needs and Advantages, Energy Conservation Act 2003.

UNIT II SOLAR ENERGY

Introduction to solar energy: solar radiation, availability, measurement and estimation–Solar thermal conversion devices and storage – solar cells and photovoltaic conversion –PV systems – MPPT. Applications of PV Systems – solar energy collectors and storage.

UNIT III WIND ENERGY

Introduction – Basic principles of wind energy conversion- components of wind energy conversion system - site selection consideration – basic–Types of wind machines. Schemes for electric generation – generator control, load control, energy storage – applications of wind energy – Inter connected systems.

3H-3C

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3 Hours

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

UNIT IV HYDRO ENERGY

Hydropower, classification of hydro power, Turbine selection, Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

UNIT V OTHER SOURCES

Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic(MHD) energy conversion.

TEXT BOOKS:

- 1. Rai.G.D, Non-conventional sources of energy Khanna publishers, 2011.
- 2. Khan.B.H, Non-Conventional Energy Resources ,The McGraw Hills, Second edition, 2012.
- 3. John W Twidell and Anthony D Weir , Renewable Energy Resources, Taylor and Francis 3rd edition, 2015

CO PO MAPPING

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	2	1	-	-	-	-	1	-	-
CO2	3	2	2	2	-	-	1	-	-	-	-	1	-	-
CO3	3	2	2	2	-	-	1	-	-	-	-	1	-	-
CO4	2	1	1	1	-	-	1	-	-	-	-	1	-	-
CO5	2	1	1	1	-	-	1	-	-	-	_	1	-	-
Avg.	2.4	1.4	1.4	1.4	-	0.4	1	-	-	-	-	1	-	-

TOTAL: 45

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B.E Electrical and Electronics Engineering 23BEEEOE02 HYBRID ELECTRIC VEHICLES

2023-2024

3H-3C

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

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3 Hours

Course Objectives The goal of this course is for students:

- To understand the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals.
- To familiarize the plug in hybrid electric drive- Train Topologies.
- To analyze electric drives suitable for hybrid electric vehicles.
- To discuss different energy storage technologies used for hybrid electric vehicles and their control.
- To demonstrate energy management strategies in hybrid electric vehicles.

Course Outcomes

Upon completion of this course, students will be able:

- 1. Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals
- 2. Analyze the use of train topologies in hybrid electric drive.
- 3. Interpret electric drives suitable for hybrid electric vehicles.
- 4 Explain the use of energy storage devices used for hybrid electric vehicles.
- 5. Analysis the performance of Energy Management strategies in HEVs.

UNIT I INTRODUCTION

History of hybrid and electric vehicles, social and environmental importance of hybrid and electricvehicles, impact of modern drive-trains on energy supplies.

UNIT II HYBRID E1ECTRIC DRIVE-TRAINS

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT III E1ECTRIC PROPU1SION UNIT

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

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UNIT IV ENERGY STORAGE

Introduction to Energy Storage Require2ents in Hybrid and Electric Vehic1es, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT V ENERGY 2ANAGE2ENT STRATEGIES

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

TEXT BOOKS:

- 1. C.Mi, M.A. Masrur and D.W.Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
- 2. S.Onori, L.Serrao and G.Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
- 3. M.Ehsani, Y.Gao, S.E.Gay and A.Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
- 4. T.Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

WEBLINKS:

- 1. https://www.energy.gov/eere/electricvehicles/electric-vehicle-basics
- 2. https://swayam.gov.in/nd1_noc20_ee18/preview3.https://nptel.ac.in/courses/108103009/
- 3. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105166/lecpdf

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

- 4. https://nptel.ac.in/courses/106105166/
- 5. https://nptel.ac.in/courses/108108098/

CO PO MAPPING

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1	2	1	-	-	-	-	1	-	-
CO2	3	3	2	2	2	-	1	-	-	-	-	1	-	-
CO3	2	2	1	1	1	-	1	-	-	-	-	1	-	-
CO4	3	3	2	2	2	-	1	-	-	-	-	1	-	-
CO5	3	3	2	2	2	-	1	-	-	-	-	1	-	-
Avg.	2.6	2.6	1.6	1.6	1.6	0.4	1	-	-	-	-	1	-	-

B.E Electronics and Communication Engineering

23BEECOE01

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

COURSE OBJECTIVES

The goal of this course for students is:

To introduce students to the embedded systems, its hardware and software. •

REAL TIME EMBEDDED SYSTEMS

- To introduce devices and buses used for embedded networking. •
- To study about task management. •
- To learn about semaphore management and message passing. •
- To study about memory management. •

COURSE OUTCOMES

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

- Explain the Embedded system's hardware and software.
- Outline the operating system for embedded applications.
- Analyse the tasks performed by Embedded system.
- Examine the activities of multiple processes in an embedded system.
- Interpret the memory management system.

UNIT I INTRODUCTION TO EMBEDDED SYSTEM

Introduction- Embedded systems description, definition, design considerations & requirements-Overview of Embedded System Architecture (CISC and RISC)-Categories of Embedded Systemsembedded processor selection & tradeoffs- Embedded design life cycle -Product specificationshardware / software partitioning- iterations and implementation- hardware software integration product testing techniques-ARM7.

UNIT II OPERATING SYSTEM OVERVIEW

Introduction–Advantage and Disadvantage of Using RTOS–Multitasking–Tasks-Real Time Kernels - Scheduler- Non-Preemptive Kernels - Preemptive Kernels - Reentrancy- Reentrant Functions-Round Robin Scheduling- Task Priorities- Static Priorities- Mutual Exclusion- Deadlock- Inter task Communication-Message Mailboxes-Message Queues- Interrupts- Task Management-Memory Management-Time Management-Clock Ticks.

UNIT III TASK MANAGEMENT

Introduction-µ C/OS-II Features-Goals ofµ C/OS-II-Hardware and Software Architecture-Kernel Structures: Tasks-Task States-Task Scheduling-Idle Task-Statistics Task-Interrupts Under µ C/OS-II-Clock Tick-µ C/OS- II Initialization. Task Management: Creating Tasks-Task Stacks-Stack Checking-Task's Priority-Suspending Task, ResumingTask.TimeManagement: Delaying a Task-Resuming a Delayed Task-System Time. Event Control Blocks-Placing a Task in the ECB Wait List–Removing a Task from an ECB wait List.

2023-2024

3H-3C

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

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UNIT IV SEMAPHORE MANAGEMENT AND MESSAGE PASSING

Semaphore Management: Semaphore Management Overview– Signaling a Semaphore. Message Mailbox Management: Creating a Mailbox –Deleting Mailbox–Waiting for a Message box–Sending Message to a Mailbox- Status of Mailbox. Message Queue Management: Creating Message Queue–Deleting a Message Queue–Waiting for a Message Queue–Sending Message to a Queue–Flushing a Queue.

UNIT V MEMORY MANAGEMENT

Memory Management: Memory Control Blocks–Creating Partition-Obtaining a Memory Block– Returning a Memory Block. Getting Started withµ C/OS-II–Installingµ C/OS-II–Portingµ C/OS-II: Development Tools–Directories and Files– Testing a Port -IAR Workbench withµ C/OS-II-µ C/OS-II Porting on a 8051CPU– Implementation of Multitasking- Implementation of Scheduling and Rescheduling –Analyze the Multichannel ADC with help ofµ C/OS-II.

TEXT BOOKS:

- 1. JeanJ. Labrosse, Micro C/OS–II The Real Time Kernel, CMPBOOKS, 2009.
- 2. David Seal, ARM Architecture, Reference Manual, Addison-Wesley, 2008.
- 3. Steve Furbe, ARM System-on-Chip, Architecture, Addison-Wesley Professional, California, 2000.
- 4. K.C. Wang, Embedded and Real-Time Operating Systems, Springer, 2017.
- 5. Janez Puhan, Operating systems, Embedded systems and Real-time systems, CIP Cataloging In Publication, 2015.

Web links

- 1. https://nptel.ac.in/courses/10810505.
- 2. https://onlinecourses.nptel.ac.in/noc21_cs98/preview.
- 3. https://nptel.ac.in/courses/108102045.
- 4. https://archive.nptel.ac.in/courses/106/105/106105193/

COs	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	2	-	-	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	1	-	-	-	-	-	-
CO3	2	3	2	2	2	-	-	-	-	-	-	-	-	-
CO4	2	3	2	2	2	-	-	-	-	-	-	-	-	-
CO5	1	2	2	-	3	-	-	-	-	-	-	-	-	-
Avg.	3	3	3	2	2	-	-	-	-	-	-	-	-	-

CO PO MAPPING

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TOTAL: 45

B.E Electronics and Communication Engineering

23BEECOE02

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

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

OURSE OBJECTIVES

The goal of this course for students is:

- To study about various speakers and microphone.
- To learn the fundamental of television systems and standards.
- To learn the process of audio recording and reproduction.
- To study various telephone networks.
- To discuss about the working of home appliances

COURSE OUTCOMES

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

- Explain working of loud speakers and Microphones
- Interpret the fundamentals of Television systems.
- Record the Audio Signal and reproduce it.
- Classify telecommunication networks.
- Examine the working of home appliances.

UNIT I LOUDSPEAKERS AND MICROPHONES

Introduction Loudspeaker, types of loud speakers, Loudspeaker characteristics, Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters – Introduction Microphone, Types of Microphones, Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones.

CONSUMER ELECTRONICS

UNIT II TELEVISION STANDARDS AND SYSTEMS

Introduction to TV system - Components of a TV system–Scanning – types of scanning-interlacing– Color TV Fundamentals - Additive Mixing- Subtractive Mixing- Need for Synchronization- Aspect Ratio- Video Bandwidth - Positive and Negative Transmission- Advantages of Negative Transmission- composite video signal - Color TV system– Luminance and Chrominance signal-Monochrome and Color Picture Tubes- Color TV systems– NTSC, PAL, SECAM.

UNIT III OPTICAL RECORDING AND REPRODUCTION

Introduction to Audio disc - Audio Disc- Processing of the Audio signal-Readout from the Disc - Reconstruction of the audio signal-Introduction to Video Disc recording -video disc mastering and replication - Video disc formats- Recording Systems-Playback Systems.

UNIT IV TELECOMMUNICATION SYSTEMS

Introduction to telecommunication Systems – Modes of telecommunication system-line system characteristics – Radio system characteristics –Signaling- Station Interconnection - Telephone services-telephone networks–switching system principles–PAPX or PBX switching–Data Services - Circuit, Packet and Message Switching, Telephone Networks - LAN, MAN and WAN, Integrated Services Digital Network. Introduction to Mobile radio systems- Wireless Local Loop – the role of WLL – types of WLL - VHF/UHF radio systems- Limited range Cordless Phones –Introduction to cellular communication - cellular modems.

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3H-3C

UNIT V HOME APPLIANCES

Introduction to home appliances – types of home appliances- Microwaves - Basic principle and block diagram of microwave oven -Washing Machine- electronic controller for washing machines - washing machine hardware and software –Introduction to air conditioners and refrigerators - Components of air conditioning systems – types of air conditioning systems- Refrigeration –Refrigeration systems – types of Refrigeration systems.

TOTAL: 45

TEXT BOOKS:

- 1. S.P. Bali Consumer Electronics Pearson Education 2007
- 2. J.S.Chitode Consumer Electronics Technical Publications 2007
- 3. Philip Hoff, Philip Herbert Hoff Consumer Electronics for Engineers Cambridge University Press 1998
- 4. R.G.Gupta Audio & Video Systems Tata Mc Graw hill Publishing Company Ltd 2004

WEB LINKS

- 1. https://nptel.ac.in/courses/117105133
- 2. https://archive.nptel.ac.in/courses/117/104/117104127/
- 3. https://nptel.ac.in/courses/117102059
- 4. https://nptel.ac.in/courses/108101091

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-	2	-	-
CO4	3	3	2	2	2	-	-	-	-	-	-	1	-	-
CO5	3	2	2	1	2	-	-	-	-	-	-	2	-	-
Avg.	2.6	2	1.7	1.7	2	-	-	-	-	-	-	1.7	-	-

CO PO MAPPING

B.E. MECHANICAL ENGINEERING

BATTERY MANAGEMENT SYSTEM 23BEMEOE01

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

COURSE OBJECTIVE

The goal of the course is:

- To learn various energy storage systems used for Hybrid Electric Vehicle (HEV) andElectric Vehicle (EV).
- To learn about design and operation of solid-state Li-ion battery.
- To gain knowledge on the high temperature application of battery. •
- To learn various technology for recycling used batteries.
- To understand the battery electrical and thermal management systems using active andpassive cooling system.

COURSE OUTCOMES

At the end of the course the student would be able:

- To understand the performance and driving cycles of EVs.
- To apply their knowledge to manufacture various types of Li-ion batteries. •
- To apply knowledge on use of Li-ion battery in large scale grid and space crafts. •
- To understand Techno-economic aspects of battery recycling and environmental safety. •
- To understand battery cooling system and safety precautions for high voltage battery.

UNIT I ENERGY STORAGE SYSTEMS

General background on alternative energy sources and sustainability, Introduction to electric-based transportation, Overview of on-road vehicle electrification, EVs configuration, Energy and power requirements for various HEVs and EVs Vehicle performance and driving cycles.

UNIT II LITHIUM BATTERIES

Li-ion batteries - Principle of operation, Battery components and design Electrode, cell and battery fabrications, Building block cells, battery modules and packs and applications. All solid-state batteries and future developments, Li-Sulphur battery, Li-Air battery, Sodium-battery, Magnesium battery, Aluminium battery, Silicon battery.

UNIT III HIGH TEMPERATURE BATTERIES FOR BACK-UP APPLICATIONS 9

Advance Ni-MH batteries for transportation, Future prospects of Ni-MH batteries vs. lithium ion batteries, Zebra cell, Li-iron sulphide cells, Vanadium and iron-based batteries, Semi-fluid flow batteries for large scale grid application, Ni-H₂ cells for space applications.

UNIT IV FUEL CELLS AND BATTERY RECYCLING TECHNOLOGY

Introduction to fuel cells, Proton-exchange membrane and alkaline fuel cells for transportation, Solid oxide fuel cells, Technology and economic aspects of battery recycling, Environmental effect and controlling of poisonous chemicals contamination.

Marks: Internal:40 External:60 Total:100

3H-3C

End Semester Exam:3 Hours

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UNIT V BATTERY MANAGEMENT

Fundamentals of battery management systems and controls, Battery Thermal Management - Passive cooling, Active cooling -Liquids & air systems.Regulations and Safety Aspects of High Voltage Batteries, Code and Standards, Safe handling of Lithium Batteries, Safety of high voltage battery.

TOTAL: 45

TEXT BOOKS:

- 1. Gerardus Blokdyk, Battery Management System A Complete Guide, Springer, 2019 Edition.
- 2. Reiner Korthauer, Lithium-Ion Batteries: Basics and Applications, 1st Edition. Springer, 2018
- 3. Alfred Rufer, Energy Storage: Systems and Components, 1st Edition, CRC Press, 2017.
- 4. Arno Kwade and Jan Diekmann, Recycling of Lithium-Ion Batteries: The LithoRec Way (Sustainable Production, Life Cycle Engineering and Management), 1st Edition. Springer, 2018.

WEB REFERENCES

1. https://nptel.ac.in/courses/108/103/108103009/

CO PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO2	PSO2
CO1	3	2	1	-	-	-	-	-	-	1	-	1	-	-
CO2	3	3	2	1	-	-	-	-	-	1	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	1	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	1	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	1	-	1	-	-
Avg.	3	2.4	1	0.2	-	-	-	-	-	1	-	1	-	-

B.E. MECHANICAL ENGINEERING

INDUSTRIAL SAFETY AND ENVIRONMENT **23BEMEOE02 3H-3C**

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

COURSE OBJECTIVES:

- To recognize and evaluate occupational safety and health hazards in the workplace.
- To determine appropriate hazard controls following the hierarchy of controls.
- To analyses the effects of workplace exposures, injuries and illnesses, fatalities.
- To prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
- To teach student the concept of Industrial Safety & provide useful practical knowledge for workplace safety.

COURSE OUTCOMES:

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

- Recognize and evaluate occupational safety and health hazards in the workplace.
- Determine appropriate hazard controls following the hierarchy of controls.
- Analyze the effects of workplace exposures, injuries and illnesses, fatalities.
- Prevent incidents using the hierarchy of controls, effective safety and health management systems and task- oriented training.
- Understand the concept of Industrial Safety & provide useful practical knowledge for workplace safety.

UNIT I CONCEPTS

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety.

UNIT II TECHNIQUES

Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

UNIT III ACCIDENT INVESTIGATION AND REPORTING

Concept of an accident, reportable and non-reportable accidents, unsafe act and condition - principles of accidentprevention, Supervisory role- Role of safety committee - Accident causation models - Cost of accident. Overall accident investigation process - Response to accidents, India reporting requirement, Planning document, Planningmatrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents, accident reports

UNIT IV SAFETY PERFORMANCE MONITORING

Reactive and proactive monitoring techniques - Permanent total disabilities, permanent partial disabilities, temporary total disabilities -Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety "t" score, safety activity rate problems.

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

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UNIT V SAFETY EDUCATION AND TRAINING

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agenciesand private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

TOTAL: 45

TEXT BOOKS:

- 1. Accident Prevention Manual for Industrial Operations, 3rd edition, N.S.C. Chicago, 2010(digital).
- 2. Heinrich H.W. "Industrial Accident Prevention", 2ndedition, Tata McGraw-Hill Company, New York, 1941.
- 3. Krishnan N.V, Safety Management in Industry, 1st edition, Jaico Publishing House, Bombay, 1997.
- 4. John R Ridley, Safety at Work,3rd edition, Elsevier,2014
- 5. Roland P. Blake, Industrial Safety, 2ndedition, Prentice Hall, Inc., New Jersey, 1973
- 6. L M Deshmukh, Industrial safety management, 1stedition, TATA McGraw Hill, 2005.

CO PO MAPPING

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

23BEMEOE03 NON-DESTRUCTIVE TESTING

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

COURSE OBJECTIVE:

- The main objectives of this course are to introduce the concept of non-destructive testing among the students and make them understand various types of non-traditional practices available for manufacturing industry.
- To provide in-depth knowledge on various techniques of non-destructive testing.
- To provide an overview of destructive and non-destructive tests and state their applications
- To study the features of NDT techniques for various products and to understand the established NDE techniques and basic familiarity of emerging NDE techniques.
- To expose students to skills needed for selection of appropriate NDT technique(s) for new inspection jobs.
- To facilitate the understanding of standard application area of NDET

COURSE OUTCOME:

Student will be able to

- Understand the codes, standards and specifications related to NDT.
- Classify the destructive and non-destructive tests and state their applications. •
- Develop NDT techniques for various products. •
- Acquire skills needed for selection of appropriate NDT technique(s) for new inspection jobs
- Acquire sound knowledge of established NDE techniques and basic familiarity of emerging • NDE techniques.
- Make use of standards application area of NDET

UNIT I INTRODUCTION

Properties of Engineering Materials - Types of Defects - Surface and Sub-Surface of a component -Characteristics of Ferrous, Non-ferrous and Alloys. Classification of Destructive testing and Non-Destructive testing – Uses and applications. Codes, Standards and Specifications of NDT (ASME, ASTM, AWS etc.). Importance and Scope of NDT, Non-destructive testing methods

UNIT II PENETRANT TESTING AND MAGNETIC PARTICLE INSPECTION

Introduction to Penetrant Testing - Liquid Penetrants and Dye Penetrants - Apparatus required for LPT - An Illustration of Penetrant Testing, Application, Advantages and Disadvantages of Penetrants Testing. Introduction to Magnetic Particle Inspection – MPT equipments and devices - An Illustration of Magnetic Particle Inspection, Application, Advantages and Disadvantages of Magnetic Particle Crack Detection.

UNIT III ULTRASONIC FLAW DETECTION AND RADIOGRAPHY INSPECTION 9

Introduction to Ultrasonic Flaw Detection, UT equipments and devices, An Illustration of Ultrasonic Flaw Detection, Application, Advantages and Disadvantages of Ultrasonic Flaw Detection.Principle of Radiography Inspection, RT equipments and devices Radiation sources, uses of x-rays and gamma rays Attenuation in the specimen, Radiographic imaging, Inspection Techniques, Application and limitations, Safety from Radiation.

End Semester Exam:3 Hours

Marks: Internal:40 External:60 Total:100

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3H-3C

UNIT IV EDDY CURRENT TESTING AND VISUAL TESTING METHODS 9 Introduction to Eddy Current Testing. ECT equipments and devices, An Illustration of Eddy Current Testing Equipment, Application, Advantages and Disadvantages of Eddy Current Testing. Introduction to visual testing method, Equipments required for VT - An Illustration of visual testing method, Application, Advantages and Disadvantages of visual testing method.

UNIT V NON-DESTRUCTIVE INSPECTION(NDI) AND ITS APPLICATIONS 9 Inspection of Raw Products, Inspection for In-Service Damage, Power Plant Inspection, Storage Tank Inspection, Automobile component Inspection, Jet Engine Inspection, Pressure Vessel Inspection, Bridge Inspection, Pipeline Inspection.

TEXT BOOKS:

- 1. Sadashiva.M Non Destructive Testing Paperback 15 July 2021.
- 2. Ramachandran.S and Anderson.A Non-Destructive Testing Kindle Edition 2018
- 3. J. Prasad and C. G. Krishnadas Nair Non-Destructive Test and Evaluation of Materials Hardcover 1 July 2017.
- 4. Lari and Kumar Basics of Non Destructive Testing Paperback 1 January 2013.
- 5. Ravi Prakash Non Destructive Testing Techniques Hardcover 1 January 2010.
- 6. Louis Cartz Non destructive Testing 1st Edition, ASM International, Almere, Netherland, 2007(digital).

CO PO	MAPPING
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COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	1	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	1	-	1	-	-
Avg.	3	2	2	1	-	-	-	-	-	1	-	1	-	-

B.E. MECHANICAL ENGINEERING

23BEMEOE04

OPERATIONS RESEARCH

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

COURSE OBJECTIVE

- To provide knowledge and training in finding optimal solutions under limited resources for the engineering and business problems.
- To study and acquire knowledge on engineering and Managerial solutions in Assignment and scheduling problems.
- To give exposure to inventory in industry.
- To make the student acquire sound knowledge on sequences to perform operation among various alternatives.
- To provide an overview of various tools in various sections of industries like marketing, material handling etc.
- To understand the Engineering and Managerial situations inTransportation.

COURSE OUTCOME

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

- Understand the concepts of Linear programming technique.
- Apply LPP technique of Transportation models. •
- Understand the techniques of scheduling and sequencing.
- Acquire knowledge in Inventory control and Queuing theory.
- Perform network analysis for a project.
- Understand the concept of replacement models.

UNIT I INTRODUCTION TO OPERATIONS RESEARCH

Operations research and decision-making - types of mathematical models and constructing the model - Roleof computers in operations research - Linear Programming Techniques: Formulation of linear programming problem, applications and limitations, graphical method, simplex method – The Big –M method - the two-phase method.

UNIT II TRANSPORTATION PROBLEMS

Least cost method, North west corner rule, Vogel's approximation method, modified distribution method, unbalance and degeneracy in transportation model, shortest route algorithm- dijkestra algorithm.

UNIT III ASSIGNMENT MODELS AND SCHEDULING

Assignment models - Hungarian algorithm, unbalanced assignment problems - maximization case inassignment problems, traveling salesman problem. Scheduling - processing n jobs through two machines, processing n jobs through three machines, processing two jobs through 'm' machines, processing n jobs through m machines.

End Semester Exam:3 Hours

Marks: Internal:40 External:60 Total:100

3H-3C

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UNIT IV INVENTORY CONTROL AND QUEUING THEORY

Variables in inventory problems, inventory models with penalty, shortage and quantity discount, safety stock, multi-item deterministic model.Queuing Models: Queues–Notation of queues, performance measures, The M/M/1 queue, The M/M/m queue, batch arrival queuing system, queues with breakdowns.

UNIT V PROJECT MANAGEMENT AND REPLACEMENT MODELS

Basic terminologies, constructing a project network, network computations in CPM and PERT, cost crashing.Replacement Models: Replacement of Items due to deterioration with and without time value of Money, Group replacement policy, Staff replacement

TOTAL:45

TEXT BOOKS:

- 1. Kanti Swarup,Operations Research,12th edition,Sultan Chand andSons,New Delhi, 2010.
- 2. Viswanathan N and Narahari Y, Performance Modeling of Automated Manufacturing Systems, 2nd edition, Prentice Hall of India,New Delhi, 2005
- 3. Prem kumar Gupta and Hira D.S, Operation Research, 1st edition, S Chand and Company Limited, New Delhi, 2017

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COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	-	-	-	-	1	-
CO2	3	3	2	1	-	-	-	-	-	1	-
CO3	2	1	3	-	-	-	-	-	-	1	-
CO4	3	2	1	-	-	-	-	-	-	1	-

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CO PO MAPPING

CO5

Avg.

3

2.8

2

2.6

1

1.6

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1

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9

PO12

1

1

1

1

1

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PSO1

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PSO2

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MASS COMMUNICATION

2023-2024

3H-3C

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

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES

On completion of the course, student will be able to

- Outline the basic concepts of communication and its types.
- Extend the knowledge with process of mass communication and their relevance.
- Explain the functions of mass communication with real time experience.
- Utilize the mass communication theories in media communication.
- Plan research proposals using international concepts in mass communication.

COURSE OUTCOMES

On completion of the course, student will be able to

- Identify the process and types of human communication.
- Recognize the function and characteristics of mass communication.
- Describe correlation and culture of mass communication.
- Replicate the concepts of mass communication theories in real life situation.
- Explain the impact of media theory in international communication

UNIT I BASIC CONCEPTS OF COMMUNICATION

Types of Communication; Functions of Mass Communication; Barriers, Intertextuality.

UNIT II MODELS AND THEORIES OF COMMUNICATION

Various models and theories of communication.

UNIT III MEDIA THEORY

Paradigm Shifts in Mass Communication Theories

UNIT IV FOLK MEDIA AND INTERNATIONAL COMMUNICATION THEORY 9

Folk Media and Electronic Media; International Communication Theories: World Systems, Dependency and Structural Media Monopoly – Cross Media Ownership.

UNIT V FOLK MEDIA AND INTERNATIONAL COMMUNICATION THEORY 9

Folk Media and Electronic Media; International Communication Theories: World Systems, Dependency and Structural Media Monopoly – Cross Media Ownership.

TOTAL: 45

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TEXT/REFERENCE BOOKS

- 1. Mass Communication in India By Keval J. Kumar, 1994
- 2. Mass Communication Theory: Foundations, Ferment and Future By Stanley J. Baran and Dennis K. Devis, 2015.
- 3. Introduction to Communication Studies By John Fiske, 2010.
- 4. Mcquail's Mass Communication Theory By Denis Mcquail, 2010.

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

CO PO MAPPING

23BTSHOE02

FUZZY MATHEMATICS

3H-3C

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

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students :

- To understand basic knowledge of fuzzy sets and fuzzy logic
- To apply basic knowledge of fuzzy operations.
- To know the basic definitions of fuzzy relations
- To apply basic fuzzy inference and approximate reasoning
- To know the applications of fuzzy Technology.
- Provide a firm basis for further reading and study in the subject.

COURSE OUTCOMES:

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

- Infer the basics of Fuzzy sets and functions.
- Utilize the method of operations in fuzzy sets.
- Interpret the idea of Fuzzy relations and relational equations.
- Make use of the Possibility theory and probability measures in Fuzzy sets.
- Apply the logic of Fuzzy decision making.

UNIT I FUZZY SETS

Fuzzy Sets: Basics Classical sets vs Fuzzy Sets – Need for fuzzy sets – Definition and Mathematical representations – Level Sets – Fuzzy functions - Zadeh's Extension Principle

UNIT II OPERATIONS ON FUZZY SETS

Operations on Fuzzy Sets Operations on [0,1] – Fuzzy negation, triangular norms, to norms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

UNIT III FUZZY RELATIONS

Fuzzy Relations Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

UNIT IV FUZZY MEASURES

Possibility Theory Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures

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UNIT V FUZZY INFERENCE

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference –Compositional rule of Inference - Efficiency of Inference - Hierarchical

TOTAL: 45

TEXT BOOKS:

- 1. George J Klir and Bo Yuan, (2003) Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall of India, New Delhi.
- 2. Zimmermann H.J. (2001) Fuzzy Set Theory and its Applications, Kluwer Academic publishers, USA.
- 3. Michal Baczynski and Balasubramaniam Jayaram, (2008) Fuzzy Implications, Springer-Verlag publishers, Heidelberg.
- 4. Kevin M Passino and Stephen Yurkovich, (1998) Fuzzy Control, Addison Wesley Longman publishers, USA.

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

CO PO MAPPING

SCIENCE AND HUMANITIES

23BTSHOE03

MATERIAL SCIENCES

3H-3C

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

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students :

- To inculcate the fundamental principles and concepts of magnetic materials for different engineering applications.
- To impart basic knowledge of superconductivity and associated applications.
- To serve the fundamental concepts of dielectric materials for diverse applications in energy engineering.
- To divulge the basics of crystals, their structures and different crystal growth techniques.
- To make the students familiar in the fundamentals of ceramics, composites and nonmaterial.

COURSE OUTCOMES:

Upon the successful completion of this course

- Illustrate the theory of magnetism and magnetic properties of the materials
- Explain the theory of superconductivity and its application in SQUID
- Infer the types of polarization and dielectric breakdown
- Outline the basics of crystals, structures and its defects
- Summarize the types of ceramics, metallic glsses and alloys

UNIT I MAGNETIC MATERIALS

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Origin of magnetic moment; Bohr magneton; comparison of Dia, Para and Ferro magnetism; Langevin theory of diamagnetism and paramagnetism; Quantum theory of paramagnetism; Curie-Weiss law; Temperature dependence of saturation magnetization; Domain theory; Hysteresis; soft and hard magnetic materials; antiferromagnetic materials; Ferrites and its applications.

UNIT II SUPERCONDUCTING MATERIALS

Superconductivity, properties; Meissner effect; Type I and Type II superconductors; London equation; BCS theory of superconductivity (Qualitative), Flux quantization; High Tc superconductors; Josephson superconductor tunnelling, DC and AC Josephson effect; Applications of superconductors, SQUID, cryotron, magnetic levitation.

UNIT III DIELECTRIC MATERIALS

Electrical susceptibility, dielectric constant; electronic, ionic, orientational and space charge polarization; frequency and temperature dependence of polarization; internal field; Clausius - Mossotti relation (derivation); dielectric loss; dielectric breakdown, uses of dielectric materials (capacitor and transformer); ferroelectricity and applications.

UNIT IV CRYSTAL PHYSICS

Lattice, Unit cell, Bravais lattice; Lattice planes; Miller indices; d spacing in cubic lattice; Calculation of number of atoms per unit cell, Atomic radius, Coordination number, Packing factor for SC, BCC, FCC and HCP structures; Crystal imperfections; Crystal growth techniques; solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative).

UNIT V NEW MATERIALS

Ceramics; types and applications; composites: classification, role of matrix and reinforcement, processing of fiber reinforced plastics; metallic glasses: types, glass forming ability of alloys, melt spinning process, applications; shape memory alloys: phases, shape memory effect, applications; nanomaterials: preparation (bottom up and top down approaches), properties and applications.

TEXT BOOKS:

- 1. C. Kittel, Introduction to Solid State Physics, 7th Edition, Wiley Eastern, New Delhi, 2006.
- 2. A. J. Dekker, Solid State Physics, Published by Macmillan India, 2000
- 3. William D CallisterJr, "Materials Science and Engineering An Introduction", John Wiley and Sons Inc.,7th edition, New York, 2006
- 4. S.O. Pillai, Solid State Physics. New Age International(P) Ltd., publishers, 2009
- 5. M.A. Wahab, Solid State Physics: Structure and Properties of Materials. Narosa Publishing House, 2009.
- 6. M. Arumugam, Materials Science. Anuradha publishers, 2010.

JOURNALS

- Nature Physics
- Journal of Applied Mechanics (ASME)
- Journal of Electronic Materials (IEEE/TMS)
- Applied Thermal Engineering (Elsevier)
- Physical Review B (American Physical Society).
- Nature Nanotechnology

WEBLINKS

- 1. https://nptel.ac.in/courses/122/103/122103011/
- 2. https://nptel.ac.in/courses/113/104/113104081/
- 3. https://nptel.ac.in/courses/108/108/108108122/
- 4. http://hyperphysics.phy-astr.gsu.edu/hbase/optmod/lascon.html

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CO PO MAPPING

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO3	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	1	I	1	-	-
CO5	2	1	-	-	-	-	-	-	-	1	-	1	-	-
Avg	2	1	-	-	-	-	-	-	-	1	-	1	-	-

GREEN CHEMISTRY

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES

23BTSHOE04

The goal of this course for students is :

- To make the students conversant about the green chemistry
- To make the student acquire sound knowledge of the atom efficient process and synthesis elaborately.
- To acquaint the student with concepts of green technology.
- To develop an understanding of the basic concepts of renewable energy resources.
- To acquaint the students with the basics information on catalysis.
- To apply the concepts of green catalysts in the synthesis.

COURSE OUTCOMES

After completion of this course, students will be able to

- Outline the basic principles of green chemistry.
- Explain the chemical synthesis in terms of atom efficiency
- Relate the concepts of green chemistry in biotechnology.
- Illustrate the importance of renewable feedstocks.
- Extend the phenomena of catalysis in green synthesis.

UNIT I INTRODUCTION TO GREEN CHEMICAL PRINCIPLES 9 Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorous solvents, green resolution of racemic mixtures, materials for a sustainable economy, chemistry of longer wear, agrochemicals: problems and green alternate solutions.

UNIT II ATOM EFFICIENT PROCESSES

Atom efficient processes, evaluating chemical reagents according to their yield and atom efficiency, examples of efficient stoichiometric and catalytic processes, atom economy and homogeneous catalysis, halide-free synthesis and alternatives to Strecker synthesis.

UNIT III BIOTECHNOLOGY AND GREEN CHEMISTRY

Bio technology and its applications in environmental protection - Bio informatics-Bio remediation, biological purification of contaminated air. Green chemistry for clean technology- Significance of green chemistry-Basic components of green chemistry, Industrial applications of green chemistry, green fuels-e-green propellants and bio catalysts.

3H-3C

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

UNIT IV RENEWABLE RESOURCES

Use of renewable materials, evaluating feedstock and starting materials and their origins, toxicity, sustainability and the downstream implications of the choice of feedstock, commodity chemicals from glucose and biomass conversion.

UNIT V CATALYSIS IN GREEN CHEMISTRY

Catalysis, energy requirements and usage, optimization of the reaction by minimizing the energy requirements, examples of efficient catalytic reactions including the use of heterogeneous catalysis, zeolites, oxidation using molecular oxygen.

TEXT BOOKS:

- 1. Sanjay K. Sharma, Ackmez Mudhoo (2010) Green Chemistry for Environmental Sustainability CRC Press, London
- 2. Chandrakanta Bandyopadhyay (2019) An Insight into Green Chemistry, Books and Allied (P) Ltd, Kolkata.
- 3. Ahluwalia V. K. (2018) Green Chemistry A Textbook 4th Reprint Narosa Publishing House Pvt. Ltd, New Delhi.
- 4. Ahluwalia V. K. and M.Kidwai (2007) New Trends in Green Chemistry 2nd edition Anamaya publishers., New Delhi.
- 5. Dr. Sunita Ratan (2012) A Textbook of Engineering Chemistry S.K. Kataria and Sons., New Delhi
- 6. Mukesh Doble. Ken Rollins, Anil Kumar (2007) Green Chemistry and Engineering, 1st edition Academic Press, Elesevier., New Delhi.
- 7. Desai K. R. (2005) Green Chemistry Himalaya Publishing House, Mumbai.

WEBLINKS

- 1. http://www.organic-chemistry.org/topics/green-chemistry.shtm
- 2. http://www.essentialchemicalindustry.org/processes/green-chemistry.html
- 3. http://www.chm.bris.ac.uk/webprojects2004/vickery/green_solvents.html
- 4. http://www.epa.gov/research/greenchemistry/
- 5. http://www.amazon.in/Green-Chemistry-Catalysis

CO PO MAPPING

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

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Total: 45

22MBAPOE301

MBA

ORGANIZATIONAL BEHAVIOUR

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

Marks: Internal:50 External:50 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

To make the students

- To understand the basic concepts of organizational behavior.
- To analyze the individual behavior traits required for performing as an individual or group.
- To obtain the perceiving skills to judge the situation and communicate the thoughts and ideas.
- To understand how to perform in group and team and how to manage the power, politics and conflict.
- To recognize the importance of organizational culture and organizational change.
- To realize the importance of groups and teamwork and managing of conflict between themembers of the organization

COURSEOUTCOMES:

Learners should be able to

- Analyse organizational behavior issues in the context of the organizational behaviortheories and concepts.
- Assess the behavior of the individuals and groups in organization and manage the stress.
- Manage team, power, politics and conflict arising between the members.
- Explain how organizational change and culture affect the working relationship withinorganizations.
- Understand and exhibit the communication skills to convey the thoughts and ideas of caseanalysis to the individuals and group.
- Understand the application of OB using appropriate concepts, logic and the torical conventions

UNIT I Organization behaviour: Introduction

Organization Behavior: Meaning and definition - Fundamental concepts of OB - Contributing disciplines to the OB field – OB Model - Significance of OB in the organization success - Challenges and Opportunities for OB.

UNIT II Behaviour and Personality

Attitudes – Sources - Types - Functions of Attitudes. Values – Importance - Types of Values. Personality – Determinants of personality- Theories of Personality - psycho-analytical, social learning, job-fit, and trait theories.

UNIT III Perception

Perception – factors influencing perception - Person Perception – Attribution Theory – Frequently Used Shortcuts in Judging Others- Perceptual Process- Perceptual Selectivity – Organization Erro of perception – Linkage between perception and Decision making.

UNIT IV Group and Stress Management

Foundation of Group Behavior - Types of Groups - Stages of Group Development - Group Norms - Group Cohesiveness – Stress – Causes of stress – Effects of Occupational Stress- Coping Strategies for Stress.

UNIT V Organization Culture and Change

Organizational culture- Characteristics of Culture- Types of Culture – Creating and Maintaining an Organizational Culture. Organizational change – Meaning - Forces for Change - Factors in Organizational Change - Resistance to change- Overcoming resistance to change.

SUGGESTED READINGS:

- Fred Luthans. (2017). Organizational Behavior: An Evidence Based Approach, 12thedition, Mcgraw Hill Education, NewDelhi.
- 2. Steven Mcshane and Mary Ann VonGlinow (2017), Organizational Behavior, 6th edition, McGrawHill Education, NewDelhi
- 3. Robbins, S. P., and Judge, T.A. (2016). Organizational Behaviour.(16thedition).New Delhi: PrenticeHall of India.
- 4. Laurie J. Mullins (2016), Management and Organisationalbehaviour, 10thedition, Pearson Education, NewDelhi
- 5. Robbins, S. P., and Judge, T.A. (2016). Essentials of Organizational Behavior.13 edition, PearsonEducation.

Web Link:

1. https://nptel.ac.in/courses/110/105/110105033/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	2	3	-	-	-	-	-	-
CO2	-	-	-	-	-	2	1	3	-	-	-	-	-	-
CO3	-	-	-	-	-	2	1	3	-	-	-	-	-	-
CO4	-	-	-	-	-	2	2	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	1	3	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	_	-	-	-
Avg	-	-	-	-	-	2	1	3	-	-	-	-	-	-

23PHPOE301

MATERIALS CHARACTERIZTION

3H--2C

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

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

Course Objectives

- To Study materials is always important, for any application, including fabrication of satellites.
- To introduce various methods available for characterizing the materials. The characterization of materials specifically addresses that portfolio with which researchers and educators must have working familiarity.
- To provide an introduction to materials characterization and its importance
- To discuss different types of characterization techniques and their uses.
- To introduce the students to the principles of optical and electron microscopy, X-ray diffraction and various spectroscopic techniques Introduction:
- To understand the materials characterization and available techniques

Course Outcomes (COs)

After completing the course the students will / can able to

- 1. Handle with X-ray, thermal, microscopic, and electrical methods of characterization.
- 2. Understand and describe the fundamental principles behind the methods of characterization which are included in the curriculum
- 3. Analyze, interpret and present observations from the different methods.
- 4. Evaluate the uncertainty of observations and results from the different methods.
- 5. Understand the history of materials science with basic understanding of metals, binary alloys, magnetic materials, dielectric materials and polymers
- 6. Understand nucleation, growth and phase transformation kinetics

UNIT-1 X-ray techniques for materials characterization X-ray diffraction: Principle, measuring system and applications for characterization of powdered materials. X-ray diffraction profile and analysis: FWHM and line broadening, Crystallite size effect and Scherrer formula, Effect of strain (tensile vs compressive, uniform vs. non-uniform) Introduction to Extended X-ray absorption fine structure (EXAFS), Surface extended X-ray absorption (SEXAFS).

- **UNIT II** Microscopic techniques Principles, instrumentations and applications of Optical microscope, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) for characterization of different samples. Energy dispersive X-ray microanalysis (EDS) - Basic aspects of Atomic force microscopy (AFM).
- **UNIT III** Spectroscopic methods Principle, instrumentation and applications of UV-Visible Diffuse Reflectance (UV-Vis DRS) spectroscopy, Ft-Ir, Raman and Fluorescence spectroscopy. Hand of experience on operation of UV-Vis-DRS, FT-IR, Raman and data analysis.
- **UNIT-IV** Thermoanalytical Methods Principle, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Temperature Analysis (DTA) and Differential Scanning Calorometry (DSC). Factors affecting the TGA/DTA/DSC results and their interpretations. Hand on on experience of operation of TG/DSC and data analysis.
- **UNIT -V** Electroanalytical Techniques Voltammetric principles, hydrodynamic voltammetry, stripping voltammetry, cyclic voltammetry, criteria of reversibility of electrochemical reactions, quasi-reversible and irreversible processes, qualitative and quantitative analysis current-potential relation applicable for Linear Sweep Voltammetry (LSV) and Cyclic Voltammetry (CV), interpretation of cyclic voltammograms and parameters obtainable from voltammograms. Hand on experience on operation of CV and data analysis.

SUGGESTED READINGS:

- 1) Theory and Applications of UV Spectroscopy, H.H.Jaffe and M.Orchin, IBH-Oxford.
- 2) Inorganic spectroscopic methods, A.K. Brisdon, Oxford Chem. Primers, 1997, New York.
- Applied Electron Spectroscopy for Chemical Analysis Ed. H. Windawi and F.L.Ho, Wiley Inter science.
- 4) Introduction to Spectroscopy, Pavia, Brooks/Cole Cenage, 4th edition, 2009, Belmont.
- 5) Introduction to Photoelectron Spectroscopy, P.K.Ghosh, John Wiley.
- 6) Fundamental of Molecular Spectroscopy, C. N. Banwell and E. McCash, Tata McGraw Hill, 4th edition, 1994, New Delhi.

Course Objectives

• Computational physics may be broadly defined as 'the science of using computers to assist in the solution of physical problems, and to further physics research.

End Semester Exam: 3 Hours

- To equip the students of M.Sc. Physics with knowledge of programming in C, roots of equation, interpolation, curve fitting, numerical differentiation, numerical integration, solution of ordinary differential equations
- To introduce students to computational methods for simulating physical systems and solving problems arising in physics and astronomy, as well as in other related fields
- Computers now play a role in almost every branch of physics like large scale quantum mechanical calculations in nuclear, atomic, molecular and condensed matter physics, large scale calculations in such fields as hydrodynamics, astrophysics, plasma physics, meteorology and geophysics etc.
- The huge increase in the power of computers in recent years has made an impact on the role of computational physics.
- This paper gives idea about different types of computations involved in Physics, like curve fitting, interpolation, extrapolation, numerical calculations etc.

Course Outcomes (COs)

After completing the course the students will/able to

- 1) Programme numerical methods and their implementation like applying to problem in
- physics, including modeling of classical physics to quantum system as well as data analysis (Linear and non linear).
- 3) Analysis techniques for propagating error, representing data graphically. Create, solve and interpret basic mathematical tool.
- 4) Program independently computers using leading-edge tools,
- 5) formulate and computationally solve a selection of problems in physics,
- 6) Use the tools, methodologies, language and conventions of physics to test and Communicate ideas and explanations.

UNIT - 1

Errors, different type of errors. Representation of numbers in computer, computer arithmetic, zero in floating point number.

UNIT - 2

Operators –finite differences, average, differential, etc., their inter-relations. Difference of polynomials. Difference equation. Interpolation. Lagrange's methods, error terms. Uniqueness of interpolating polynomial.

UNIT - 3

Newton's fundamental interpolation. Forward, backward and central difference interpolations. Interpolation by iteration. Spline interpolation, comparison with Newton's interpolation. Hermite's interpolation. Bivariate interpolation, Lagrange and Newton's methods. Inverse interpolation.

UNIT - 4

Approximation of function. Least square method. Use of orthogonal polynomials. Approximation by Chebyshev polynomials, Max-min principle. Economization of power series.

UNIT-5

Python Programming –Loops- Conditional statements- Functions- Object-oriented programming- Array computing- 2 and 3d visualizations

SUGGESTED READINGS:

1. E. Balagurusamy, "Numerical Methods", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1999

2. W.H. Press, B.P. Flannery et al., "Numerical Recipes: Art of Scientific Computing", 3rd Edition, Cambridge Press, 2007.

3. J. M. Mathews and K. Fink, "Numerical Methods using MATLAB ", 4rd Edition, Prentice Hall Publication, 2004

4. Dr. B.S. Grewal, "Numerical Methods in Engineering and Science ", Khanna Publication.

5. Robert J schilling, Sandra l harries, "Applied Numerical Methods for Engineers using MATLAB and

C.", Thomson Brooks/cole.

- 6. Richard L. Burden, J. Douglas Faires, "Numerical Analysis", Thomson / Brooks/cole
- 7. John. H. Mathews, Kurtis Fink ,"Numerical Methods Using MATLAB" ,Prentice Hall publication
- 8. JAAN KIUSALAAS, "Numerical Methods in Engineering with MATLAB", Cambridge Publication

9. https://archive.nptel.ac.in/content/

CO-PO Mapping

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	I	1	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	1	-	-	-	1	-	-	-	-	-	-	1	-	-
CO4	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO5	1	-	-	_	-	-	-	-	-	-	_	1	-	-
Avg.	1	1	-	-	-	-	-	-	-	-	-	1	-	-

23CAPOE301

ROBOTICS PROCESS AUTOMATION

3H--2C

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

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

Course objectives

Enable the student

- Learn the concepts of RPA, its benefits, types and models
- Gain the knowledge in application of RPA in Business Scenarios
- Identify measures and skills required for RPA
- Adopt to the implementations of Automation
- Able to process information and draw inference
- Understand the concepts of robot skills

Course Outcomes (COs)

Upon completion of this course students will be able to:

- 1. Demonstrate the benefits and ethics of RPA K1, K2
- 2. Understand the Automation cycle and its techniques K2
- 3. Draw inferences and information processing of RPA K3, K4
- 4. Understand the Automation concepts
- 5. Implement & Apply RPA in Business Scenarios K5
- 6. Analyze on Robots & leveraging automation

Unit I - Introduction

Introduction to RPA - Overview of RPA - Benefits of RPA in a business environment - Industries & domains fit for RPA - Identification of process for automation - Types of Robots - Ethics of RPA & Best Practices - Automation and RPA Concepts - Different business models for implementing RPA - Centre of Excellence – Types and their applications - Building an RPA team - Approach for implementing RPA initiatives.

Unit II - Automation

Role of a Business Manager in Automation initiatives - Skills required by a Business Manager for successful automation - The importance of a Business Manager in automation - Analyzing different business processes - Process Mapping frameworks - Role of a Business Manager in successful implementation – Part 1 - Understanding the Automation cycle – First 3 automation stages and activities performed by different people

Unit III - Automation Implementation

Evaluating the Automation Implementation Detailed description of last 3 stages and activities performed by different people - Role of a Business Manager in successful completion – Part 2 - Activities to be performed post-implementation - Guidelines for tracking the implementation success -Metrics/Parameters to be considered for gauging success - Choosing the right licensing option - Sending emails - Publishing and Running Workflows

Unit IV – Robot

Ability to process information through scopes/systems - Understand the skill of information processing and its use in business - Leveraging automation - Creating a Robot - New Processes. Establish causality by variable behavior - Understand the skill of drawing inference or establishing causality by tracking the behavior of a variable as it varies across time/referenced variable - Leveraging automation for this skill - Robot & new process creation.

Unit V – Robot Skill

Inference from snapshots of curated terms – Omni-source data curation - Multisource trend tracking -Understand the skill of drawing inference from the behavior of curated terms by taking snapshots across systems in reference to time/variable(s) - Leveraging automation for this skill – Robot creation and new process creation for this skill.

Suggested Readings

- Tom Taulli, February 2020. "The Robotic Process Automation Handbook" Apress, Reference Books
 Steve Kaelble" Robotic Process Automation" John Wiley & Sons, Ltd.
- 2.Alok Mani Tripathi, March 2018. "Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool", Packet Publishing Limited

Websites

- 1. https://www.tutorialspoint.com/uipath/uipath_robotic_process_automation_introduction.htm
- 2. https://www.javatpoint.com/rpa 3 https://onlinecourses.nptel.ac.in/noc19_me74/preview

23BCPOE301

NUTRITION AND DIETETICS

3H-2C

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

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

Course Objectives The goal of this course is for students,

- To understand the Fundamentals of food, nutrients, and their relationship to health
- To identify deriving maximum benefit from available food resources
- To understanding of the consequences of vitamin and mineral deficiency/ excess vitamin
- To describe the nutrition deficiency diseases and their consequences
- To explain Food adulteration and prevention of food adulteration.

Course Outcomes (CO's) Upon completion of the course, students will be able to,

- Understand the fundamentals of nutrition and their relationship to health
- Identify the maximum benefits from available food resources
- Outline the consequences of vitamin and mineral deficiency/excess vitamin
- Illustrate nutrition deficiency diseases and their consequences
- Explain the sources of food adulteration and measures to prevent it

UNIT 1

9

Basic concepts in food and nutrition- Understanding relationship between food, nutrition and health, Functions of food- Physiological, psychological and social. Dietary guidelines for Indians food pyramid. Junk foods and its causes.

UNIT II

9

Nutrients - Functions, dietary sources and clinical manifestations of deficiency/ excess of the following nutrients: Carbohydrates, lipids and proteins, Fat soluble vitamins-A, D, E andK, Water soluble vitamins – thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C, Minerals – calcium, iron and iodine
UNIT III

Adult nutrition:Physiological changes, RDA, nutritional guidelines, nutritional concerns and healthy food choices -Adult, Pregnant woman, Lactating mother, Elderly. Nutrition during childhood -Growth and development, nutritional guidelines, nutritional concerns and healthy food choices -Infants, Preschool children, School children, Adolescents. Nutritional needs of nursing mothers and infants, determinants of birth weight and consequences of low birth weight, Breastfeeding biology, Breastfeeding support and Counselling, Infant and young child feeding and care - Current feeding practices and nutritional concerns, guidelines for infant and young child feeding, Breast feeding, weaning and complementary feeding. Assessment and management of moderate and severe malnutrition among children, Micronutrient malnutrition among preschool children. Child health and morbidity, neonatal, infant and child mortality.

UNIT IV

Introduction to Nutritional deficiency diseases -Causes, symptoms, treatment, prevention of the following: Protein Energy Malnutrition (PEM), Vitamin A Deficiency (VAD), Iron Deficiency Anaemia (IDA), Iodine Deficiency Disorders (IDD), Zinc Deficiency, Flurosis Nutritional needs during pregnancy, common disorders of pregnancy (Anaemia, HIV infection, Pregnancy induced hypertension), relationship between maternal diet and birth. Maternal health and nutritional status, maternal mortality and issues relating to maternal health.

UNIT V

Dietetics : Diet for diabetes mellitus-Nutrition recommendations for patient with diabetes, Meal planning, Exchange list of different food groups, Glycemic index based formulation of diet for diabetic individual, Diabetic diets menu wise. Diet for Cardiovascular Diseases -Dietary management and general guidelines for coronary heart disease, Dietary recommendations of WHO. Diet for Acute cardiac diseases. Influence of diet on carcinogenesis, Dietary risk factors and cancers at various sites in the human body, diet therapy, diet for cancer patients, managing eating problems during treatment. Hormonal imbalance-Poly cystic ovarian syndrome, hypogonadism, cushing syndrome. Causes of hormonal imbalance. Treatment- Dietary and stress management protocols to be followed.

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SUGGESTED READING

- Gordon M, Wardlaw and Paul M. (2012). Perspectives in Nutrition: U.S.A. McGraw Hill Publishers. 9rd Edition. New Delhi
- Srilakshmi.B. (2014) Nutrition Science: New Age International (P)Ltd. Publishers.4th Edition. New Delhi.
- 3. Srilakshmi.B. (2015) Food Science: New Age International (P) Ltd. Publishers. 6nd Edition., New Delhi
- Darshan Sohi (2012). A Comprehensive Textbook of Nutrition & Therapeutic Diets. Jaypee Brothers Medical Publishers Pvt. Ltd.

CO – PO Mapping

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	2	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	1	-	-	-
Avg	2	1	-	-	-	-	-	-	-	-	1.2	-	-	-

CYBER FORENSICS

3H - 2C

InstructionHours/week:L: 3 T:0 P: 0

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

Course Objectives

- To understand about computer forensics and investigations.
- To know about digital evidence and crime.
- To analyse and validate forensics data.
- To know about e-mail investigation.
- To understand about Mobile device forensics.

Course Outcomes (COs)

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

- Define, understand and explain various investigation procedures and summarize duplication of digital evidence.
- Apply the knowledge of digital evidences.
- Design and develop various forensics tools and analyse the network forensics.
- Demonstrate the systematic study of high-tech forensics
- Understand the importance of reports.

Unit I – Computer forensics and investigations

Computer forensics and investigations as a profession – Preparing for computer investigations – Taking a systematic approach-Procedures for corporate high-tech investigations-Data recovery work stations and software-Conducting an investigation.

Unit II – Data Acquisition

Data acquisition – Storage formats for digital evidence – Validating data acquisitions – Processing crime and incident scenes-Identifying digital evidence-Collecting evidence in private sector incident scenes – Preparing for search-seizing digital evidence at the scene-storing digital evidence – Reviewing a case.

Unit III – Computer Forensics Tools

Current computer forensics tools-Software tools-Hardware tools-The Macintosh file structure and boot process - Computer forensics analysis and validation - Addressing data -Hiding techniques.

Unit IV – Network Forensics

Virtual machines – Network forensics – Developing standard procedures – Live acquisitions – email investigations - Investigating e-mail crimes and violations - Understanding e-mail servers - Cell phone and mobile device forensics.

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Unit V – Mobile Device Forensics

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Understanding mobile device forensics – Acquisition procedures –Report writing for high-tech investigations – Importance of reports – Guidelines for writing reports –Expert testimony in high-tech investigations.

SUGGESTED READINGS

- 1. Bill Nelson, Amelia Phillips and Christopher Steuart. (2018). Computer Forensics and Investigations, Cengage Learning, 5th Edition.
- Eoghan Casey.(2017). "Handbook of Digital Forensics and Investigation", Academic Press, 1st Edition,
- 3. John R Vacca, (2016). "Computer Forensics", Cengage Learning, 2nd Edition.

WEB LINKS

- 1. www.cps.brockport.edu/~shen/cps301/figures/figure1.pdf
- 2. www.forensicsguru.com/devicedataextractionsimcell.php
- 3. www.nptel.ac.in/courses/106101060
- 4. www.samsclass.info/121/ppt/ch11.ppt
- 5. www.garykessler.net/library/role_of_computer_forensics.html

6. www.ukessays.com/essays/information-technology/computer-forensics-and-crime investigations-information-technology-essay.php

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	-	2	1	1
CO2	3	3	3	-	-	-	-	-	-	-	-	2	1	1
CO3	3	2	2	2	-	-	-	-	-	-	-	2	1	1
CO4	2	2	2	2	-	-	-	-	-	-	-	2	1	1
CO5	1	1	1	1	-	-	-	-	-	-	-	2	1	1
Avg	2.2	2.2	2.2	1.75	-	-	-	-	-	-	-	2	1	1

CO PO Mapping

23CMPOE301

3H-3C

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

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

COURSE OBJECTIVES:

- To familiarize with regard to the concept of Investment Planning and its methods
- To examine the scope and ways of Personal Tax Planning;
- To analyze Insurance Planning and its relevance
- To develop an insight into retirement planning and its relevance.
- To construct an optimal portfolio in real life situations

COURSE OUTCOMES:

- Familiarize with regard to the concept of Investment Planning and its methods
- Examine the scope and ways of Personal Tax Planning;
- Analyze Insurance Planning and its relevance
- Develop an insight in to retirement planning and its relevance.
- Construct an optimal portfolio in real life situations

UNIT I

Introduction to Financial Planning - Financial goals, Time value of money, steps in financial planning, personal finance/loans, education loan, car loan & home loan schemes. Introduction to savings, benefits of savings, management of spending & financial discipline, Net banking and UPI, digital wallets, security and precautions against Ponzi schemes and online frauds such as phishing, credit card cloning, skimming.

UNIT II

Investment Planning - Process and objectives of investment, Concept and measurement of return & risk for various assets class, Measurement of portfolio risk and return, Diversification & Portfolio formation. Gold Bond; Real estate; Investment in Greenfield and brownfield Projects; Investment in fixed income instruments- financial derivatives & Commodity market in India. Mutual fund schemes including SIP; International investment avenues.

UNIT III

Personal Tax Planning - Tax Structure in India for personal taxation, Scope of Personal tax planning, Exemptions and deductions available to individuals under different heads of income and gross total income, Special provision u/s 115BAC vis-à-vis General provisions of the Income-tax Act, 1961. Tax avoidance versus tax evasion.

UNIT IV

Insurance Planning - Need for Protection planning. Risk of mortality, health, disability and property. Importance of Insurance: life and non-life insurance schemes. Deductions available under the Income-tax Act for premium paid for different policies.

UNIT V

Retirement Benefits Planning - Retirement Planning Goals, Process of retirement planning, Pension plans available in India, Reverse mortgage, New Pension Scheme. Exemption available under the Income-tax Act, 1961 for retirement benefits.

SUGGESTED READINGS

- 1. Indian Institute of Banking & Finance. (2017). Introduction to Financial Planning. New Delhi: Taxmann Publication.
- 2. Pandit, A. (2014). The Only Financial Planning Book that You Will Ever Need. Mumbai: Network Publications Ltd.
- 3. Sinha, M. (2008). Financial Planning: A Ready Reckoner. New York: McGraw Hill Education.
- 4. Halan, M. (2018). Let's Talk Money: You've Worked Hard for It, Now Make It Work for You. New York: HarperCollins Publishers.
- 5. Tripathi, V. (2017). Fundamentals of Investment. New Delhi: Taxmann Publication.

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

CO-PO MAPPING:

23CHPOE301CHEMISTRY IN EVERYDAY LIFE3H -2C

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

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

Course Objectives

This course enables the students to

- Gain knowledge in the importance of chemistry in food industry.
- Understand the chemistry of medicines and cosmetics.
- Evaluate the solar energy utilization and its storage.
- Knowledge about the production of electricity by a nuclear reactor.
- Know about the chemistry of soaps, detergents and textiles.
- Know about the chemistry behind the polymers, fuel and agriculture.

Course Outcomes

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

- 1. Know the importance of chemistry in food industry.
- 2. Understood the chemistry of medicines and cosmetics.
- 3. Evaluate the solar energy utilization and its storage.
- 4. Understood the production process of electricity by a nuclear reactor.
- 5. Know about the chemistry of soaps, detergents and textiles.
- 6. Know the chemistry behind the polymers, fuel and agriculture.

UNIT - I Importance of Chemistry in food

Chemicals in food, colouring agents, artificial preservatives, flow stabilizers, binding substance, flavours and sweeteners, antioxidants, minerals, vitamins. Chemistry at the breakfast table, raising agents- gluten, the taste maker- glutamic acid, stimulants-Caffeine, chemistry of onion, garlic and curcumin.

UNIT - II Chemistry in medicines and cosmetics

Elements in the human body, drugs and their classification, drug-target interaction, action of different classes of drugs, antiseptics and disinfectants. Cosmetics: Chemistry behind the lotions, fragrances, talcum powder, sunblock and sunscreen, toothpaste, lipsticks, nail polishes.

UNIT - III Chemistry in energy

Solar energy - fuel from sun light - splitting of water - hydrogen from sunlight - hydrogen economy - fuel cells - batteries - photovoltaics - stealing the sun - nuclear energy - nuclear fission and fusion - production of electricity by a nuclear reactor - radioactivity and the hazards of radioactivity - living with nuclear power.

UNIT - IV Importance of chemistry in soaps, detergents and textiles

Detergents and soaps, types of soaps and detergents, saponification, cleansing action of soaps and detergents, perfumes used in soaps.Textiles: Chemistry behind wool, silk, jute, cotton, glass fibre, polyester, acrylic, nylon, and other raw materials.

UNIT - V Chemistry of polymers, fuel and agriculture

Polymers, types, polyethylene, plastics, disposal of plastics, degradation of polymers and plastics using nano materials. Petrochemistry, petrol, diesel, LPG, CNG, kerosene, oils, and other fuels. Agriculture: fertilizers, herbicides, insecticides, and fungicides.

SUGGESTED READINGS

- Tripathy, S. N., & Sunakar Panda (2004). *Fundamentals of Environmental Studies* (II Edition). New Delhi: Vrianda Publications Private Ltd.
- 2. Arvind Kumar (2004). *A Textbook of Environmental Science*. New Delhi: APH Publishing Corporation.
- 3. Anubha Kaushik, C. P., & Kaushik (2004). *Perspectives in Environmental Studies*. New Delhi: New Age International Pvt. Ltd. Publications.
- Seymour R. B., & Charles, E. (2003). Seymour's Polymer Chemistry: An Introduction. Marcel Dekker, Inc.
- 5. Stocchi. E, (1990). Industrial Chemistry (Vol-I). UK: Ellis Horwood Ltd.
- 6. Jain, P. C., & Jain, M. (2004). Engineering Chemistry. Delhi: Dhanpat Rai & Sons.
- 7. Sharma, B. K., & Gaur, H. (1996). Industrial Chemistry. Meerut : Goel Publishing House.

23MBPOE301

FERMENTATION TECHNOLOGY

3H-2C

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

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

COURSE OBJECTIVE

- To encompass the use of microorganisms in the manufacture of food or industrial products on the basis of employment.
- Get equipped with a theoretical and practical understanding of industrial microbiology
- Appreciate how microbiology is applied in the manufacture of industrial products
- Know how to source microorganisms of industrial importance from the environment
- Know about the design of bioreactors, factors affecting growth and production, heat transfer, oxygen transfer
- Understand the rationale in medium formulation & amp; design for microbial fermentation, and sterilization of medium and air.

COURSE OUTCOME

Students will be able to

- Provides knowledge in the large-scale production of industrial products, and teaches the modern employment trends to cater to the needs of industry.
- Students will differentiate the types of fermentation processes
- Understand the biochemistry of various fermentations
- Identify techniques applicable for the Improvement of microorganisms based on known biochemical pathways and regulatory mechanisms
- Comprehend the techniques and the underlying principles in downstream processing
- Students can able to explore practical skills in research activities.

Unit I - Basics of fermentation processes

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Definition, scope, history, and chronological development of the fermentation industry. Component parts of the fermentation process. y. Component parts of fermentation process. Microbial growth kinetics, batch and continuous, direct, dual or multiple fermentations; scaleup of fermentation, comparison of batch and continuous culture as investigative tools, examples of the use of fed batch culture.

Unit II Isolation and Preservation

Isolation, preservation, and strain improvement of industrially important microorganisms. Use of recombination system (Parasexual cycle, protoplast fusion techniques), application of recombinant strains, and the development of new fermentation products.

Unit III –Screening and Inoculum development

Screening (primary and secondary screening); detection and assay of fermentation products (Physicochemical assay, biological assays). Inoculum development, criteria for transfer of inoculum, development of inoculum: Bacteria, Fungi and Yeast.

Unit IV–Microbial Production

Fermentation-type reactions (Alcoholic, bacterial, mixed acid, propionic acid, butanediol and acetonebutanol). Microbial production of enzymes (amylases, Proteases, cellulases, pectinases, and lipases) primary screening for producers, large-scale production. Immobilization methods.

Unit V – Alcohols and Beverages

Fermentative production of industrial alcohol, production of beverages. Production of organic acids: citric acid, aminoacids: glutamic acid, production of vitamins. fungal enzymes and Single cell protein.

SUGGESTED READING

- 1. Casida, L.E.2007. Industrial microbiology, new age international (P) Ltd., New Delhi.
- 2. Clark, D.P and Pazdernik, N.J.2009. Biotechnology applying the genetic revolution, Elsevier Academic Press, UK.
- 3. Glazer, A and Nikaido.1995. Microbial biotechnology fundamentals of applied microbiology, W.H.Freemn and company, USA.
- 4. Glick, B.R and Pasternak, J.J.2003. Molecular Biotechnology Principles and Applications of Recombinant DNA, 3rd edition, ASM Press, USA.
- 5. Harider, S.I. and Ashok, A. 2009. Biotechnology, A Comprehensive Training Guide for the Biotechnology Industry, CRC Press, New York.
- 6. Sridhar, S.2010. Industrial Microbiology, Dominant Publishers, New Delhi.

7. Tanuja.S and Purohit, S.S. 2008. Fermentation Technology, Agrobios Publication, Jodhpur, India.

CO PO Mapping

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	1	1	-	-
CO2	2	1	2	-	-	-	-	-	-	-	1	1	-	-
CO3	2	-	-	-	-	-	-	-	-	-	1	1	-	-
CO4	2	1	2	-	-	-	-	-	-	-	1	1	-	-
CO5	2	-	-	-	-	-	-	-	-	-	1	1	-	_
Avg.	2.2	2	2	-	-	-	-	-	-	-	1	1	-	-

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TOTAL: 45

23EGPOE301

ENGLISH FOR COMPETITIVE EXAMINATION 3H-2C

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

Marks:Internal:40 External:60 Total:100

EndSemesterExam:3Hours

Course Objectives

- To train learners to crack competitive exams
- To know of various tools that is essential for Competitive Exams
- To enhance their ability to speak in English and face an interview.
- To make the student apply, prepare and clear the competitive exams.
- To prepare the student to concentrate, stay positive and confident.
- To take even failure at ease and continue the target of clearing competitive exams.

Course Outcomes

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

- The student may settle in life with a government job.
- The student may develop various skills
- The successful student may guide other students to success.
- Analyse logical reasoning questions, error analysis, and correct usage of words.
- Develop the knowledge of grammatical system of English language.
- Elaborate on the correct structure of sentence

UNIT I Grammar

Number-Subject, Verb and Agreement-Articles-Sequences of Tenses-Common Errors

UNIT II Word Power

Idioms and Phrases-One word substitution-Synonyms-Antonyms-Words often confused

UNIT III Paragraph

Expansion of an idea

UNIT IV Writing

Essay- Letters-Memos-Agenda-Resume writing

UNIT V Speaking

Public Speaking-Group discussion-Interview-Spoken English

SUGGESTED BOOKS

1. V. Saraswathi, Maya K. Mudbhatkal (2014). English for Competitive Examinations. Emerald: Chennai.

CO-PO Mapping

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

SERICULTURE

3H-2C

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

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

COURSE OBJECTIVE

The main objectives of the course are

- To apply knowledge and skills of seribiotechnology for development new mulberry variety and silkworm breeds suitable for varied agro-climatic zones.
- To apply tools and techniques of biostatics for critical analysis and interpretation of data accrueded.
- To use bioinformatics tools and techniques for the analysis and interpretation of bimolecular data for better understating mulberry and silkworm.
- To demonstrate communication skills, scientific writing, data collection and interpretation abilities in all the fields of seribiotechnology.
- Thorough knowledge and application of good laboratory and good manufacturing practices in sericulture and biotech industries.
- To demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises.

COURSE OUTCOMES

On completion of the course, students are able to

- Recall the different components and chain link of sericulture industry.
- Interpret the concepts of sericulture industry and demonstrate interdisciplinary skills acquired in mulberry plant cultivation and silkworm rearing.
- Demonstrating the Laboratory and field skills in mulberry cultivation and silkworm rearing with an emphasis on technological aspects.
- Extend the knowledge and technical skills to the Seri-farmers.
- Infer the environmental issues and apply in management of mulberry garden and silkworm rearing at field.
- Outline the comprehensive innovations and skills in improvement of mulberry and silkworm varieties for betterment of sericulture industry and human welfare.

UNIT I

Introduction to Sericulture - History of Sericulture – Sericulture organization in India, By products of silk industry. Mulberry and Non – mulberry silkworm types–Morphology and Life cycle of Bombyxmori,

UNIT II

Mulberry Cultivation: Mulberry Varieties – Methods of Irrigation –Nutrient Management and Weed control. Pruning and Harvesting – Crop improvement – Me chanism in Moriculture – Pest and

Disease, deficiencies and symptoms in Mulberry.

UNIT III

Rearing of silkworm – Rearing Appliances – rearing operation. Harvesting and marketing of cocoons. Cocoon processing and reeling - Appliances used for reeling. Pre reeling process – Cocoon boiling. Reeling technology – re-reeling technology.

UNIT IV

Non – Mulberry Sericulture Scope of Non-mulberry Sericulture - Non-mulberry silk varieties and fauna, tasar, muga, eri – Silk Production and Marketing – Tropical tasar / muga – Morphology, anatomy grainage

UNIT V

Diseases of silkworm –Pebrine Protozoan, Flacheriebacterial,Nuclear Polyhedrosisviral and Muscardine fungal diseases. Pests of Silkworm.

REFERENCES:

1. Krisnamoorthy S., Improved Method of Rearing Young Age Silk Worms: Reprinted by CSB, Bangalore, 1986.

2. Tanaka Y., Sericology, CSB, Pub., Bangalore, 1964.

3. Ullal S.R., and Narasimhan M.N., Hand Book of Practical Sericulture, CSB, Bangalore, 1987.

4. HisaoAruga, Principles of sericulture, Oxford and IBH Publishing Company, 1994.

5. Hrccrama Reddy, G. 1998. Silkworm Breeding, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

6. Otsuki el.al. 1987. Silkworm Egg Production (Translated from Japanese Language), Oxford wild IBH Publishing Co. Pvt. Ltd., New Delhi.

7. Yasuji Hamamura, 2001 Silkworm Rearing on Artificial Diet (Translated from Japanese Language), Oxford wild IBH Publishing Co. Pvt. Ltd., New Delhi.

8. Mahadevappa, D. Halliyal, V.G., Sankar, D.G and Bhandiwad, R. 2000. Mulberry Silk Reeling Technology, Oxford wild IBH Publishing Co. Pvt. Ltd., New Delhi.

9. Dandin, S.B et.al. 2003. Advances in Tropical Sericulture, National Academy of Sericulture Sciences India, Central Silk Board, Bangalore, India.

10. Ganga G., Sulochanachetty. J. An Introduction of Sericulture. Oxford, New Delhi – 1977.

11. Johnson M., and Kesary M., Sericulture, CSI Press, Marthandam, 2008.

12. Text Book of Tropical Sericulture, Pub., Japan Overseas Volunteers, 1975

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	P08	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	1	-	-	-	-	-	-	-	-	-
CO3	2	1	1	1	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	1	-	-	-	-	1
CO5	2	2	-	2	-	-	2	-	-	-	-	-
CO6	2	2	1	-	-	-	-	-		-	-	1
Avg	1.8	1.6	1	1.5			1.5					1

23MMPOE301

CODING THEORY

2023-2024 3H-2C

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

Marks:Internal:40 External:60 Total:100

EndSemesterExam:3Hours

Course Objectives

This course enables the students to learn

- Elements of coding theory and its applications.
- Understand the concept of bounds in coding theory.
- About the encoding and decoding.
- Analyze the concept of cyclic coding
- Acquiring the knowledge special cyclic codes.

Course Outcomes

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

- Recognize the basic concepts of coding theory.
- Understand the importance of finite fields in the design of codes.
- Detect and correct the errors occur in communication channels with the help of methods of coding theory.
- Apply the tools of linear algebra to construct special type of codes.
- Use algebraic techniques in designing efficient and reliable data transmission methods.

UNIT I - ERROR DETECTION, CORRECTION AND DECODING

Communication channels – Maximum likelihood decoding – Hamming distance – Nearest neighbourhood minimum distance decoding – Distance of a code.

UNIT II - LINEAR CODES

Linear codes – Self orthogonal codes – Self dual codes – Bases for linear codes – Generator matrix and parity check matrix – Enconding with a linear code – Decoding of linear codes – Syndrome decoding.

UNIT III - BOUNDS IN CODING THEORY:

The main coding theory problem – lower bounds - Sphere covering bound – Gilbert Varshamov bound – Binary Hamming codes – q-ary Hamming codes – Golay codes – Singleton bound and MDS codes – Plotkin bound.

UNIT IV - CYCLIC CODES:

Definitions – Generator polynomials – Generator matrix and parity check matrix – Decoding of Cyclic codes.

UNIT V - SPECIAL CYCLIC CODES:

BCH codes - Parameters of BCH codes - Decoding of BCH codes - Reed Solomon codes.

SUGGESTED BOOKS

- 1. San Ling and Chaoping Xing (2004). Coding Theory: A first course, Cambridge University Press.
- 2. Lin. S & Costello. D. J. (1983). Jr., Error Control Coding: Fundamentals and Applications, Prentice-Hall, Inc., New Jersey.
- 3. Vera Pless (1982). Introduction to the Theory of Error Correcting Codes, Wiley, New York.
- 4. Berlekamp E.R. (1968). Algebriac Coding Theory, Mc Graw-Hill.
- 5. H. Hill (1986). A First Course in Coding Theory, OUP.

WEB LINKS

- 1. https://www.youtube.com/watch?v=XepXtl9YKwc
- 2. https://www.youtube.com/watch?v=oeQWxhlnCHM
- 3. https://www.youtube.com/watch?v=Z-QGtxlQWak

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	3	-	-	-
CO2	-	-	-	-	-	-	3	-	-	-
CO3	-	-	-	-	-	-	3	-	-	-
CO4	-	-	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	-	3	-	-	-
Avg	-	-	-	-	-	-	3	-	-	-

CO-PO Mapping

P804ET PHARMACEUTICAL REGULATORY SCIENCE 4H-4C

Instruction Hours/week: L:3T:1 P:0 Marks:Internal:25 External:75 Total:100

EndSemesterExam:3Hours

Course Objectives:

- This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia, UK etc.
- It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.
- To know the process of drug discovery, development and generic product development
- To understand the regulatory approval process and registration procedures for API and drugproducts in various countries
- To learn the basic understanding of regulations of India with other global regulated markets
- It gives basic understanding of developing clinical trial protocols

Course Outcomes:

On successful completion of the course the student will

- 1. Explain the process of drug discovery, development and generic product development
- 2. Describe the regulatory approval process and registration procedures for API and drug products various countries.
- 3. Understand the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals in India and other global regulated markets.
- 4. Explain basic understanding of developing clinical trial protocols
- 5. Understand the concept of pharmacovigilance and its significance.
- 6. Understand the guidance and laws in regulations are regulatory market.

UNIT I

New Drug Discovery and development: Stages of drug discovery, Drug development process, preclinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.

UNIT II

Regulatory Approval Process: Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA).Changes to an approved NDA / ANDA. **Regulatory authorities and agencies:** Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada

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(Organization structure and types of applications)

UNIT III

Registration of Indian drug product in overseas market: Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD) research.

Clinical trials: Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials.

UNIT V

UNIT IV

Regulatory Concepts: Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book.

SUGGESTED READINGS

- 1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
- 2.

he Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berr y and Robert P.Martin, Drugs and the Pharmaceutical Sciences, Vol.185. Informa Health care Publishers.

3. N ew Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD,

5th edition, Drugs and the Pharmaceutical Sciences, Vol.190.

- 4. Guidebook for drug regulatorysubmissions / Sandy Weinberg. By John Wiley & Sons. Inc.
- 5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
- 6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143.
- 7. Clinical Trials and Human Research: A Practical Guide to Regulatory ComplianceBy Fay A. Rozovsky and Rodney K. Adams.
- 8. Principles and Practices of Clinical Research, Second Edition Edited by John I.Gallin and Frederick P. Ognibene.
- 9. Drugs: From Discoveryto Approval, Second Edition By Rick Ng.

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

PHARMACY

23BP804ET PHARMACEUTICAL REGULATORY SCIENCE 4H-4C

Instruction Hours/week: L:3T:1 P:0 Marks:Internal:25 External:75 Total:100

EndSemesterExam:3Hours

Course objective:

- To know the cosmetics in day to day life.
- To understand the formulation characteristics of cosmetic preparations
- To understand the role of herbs in cosmetic science
- To Demonstrate the evaluation procedures in the formulation of cosmetics
- To Identify the problems encountered during the usage of cosmetics
- To illustrate the role of nutraceuticals in day to day life

Course Outcomes:

On successful completion of the course the student will

- 1. Discover the cosmetics in day-to-day life.
- 2. Formulation's Development and characteristics of various cosmetic products.
- 3. Understand about principles and building blocks of skin and hair care products.
- 4. Understand the role of herbs in cosmetic science
- 5. Understand the principles of cosmetic evaluation including various parameters
- 6. Illustrate the important role of nutraceuticals in day -to -day life.

UNIT I

Classification of cosmetic and cosmeceutical products definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs. **Cosmetic excipients:** Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application. **Skin:** Basic structure and function of skin. **Hair:** Basic structure of hair. Hair growth cycle. **Oral Cavity:** Common problem associated with teeth and gums.

UNIT II

Principles of formulation and building blocks of skin care products: Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmeceuticals. **Antiperspants & deodorants**- Actives & mechanism of action. Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioner, anti-dandruff shampoo. Hair oils. Chemistry and formulation of Para-phylene diamine based hair dye. Principles of formulation and building blocks of oral care products:

2023-2024

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Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

UNIT III

Sun protection, Classification of Sunscreens and SPF. **Role of herbs in cosmetics:** Skin Care: Aloe and turmeric Hair care: Henna and amla. Oral care: Neem and clove **Analytical cosmetics:** BIS specification and analytical methods for shampoo, skin- cream andtoothpaste.

UNIT IV

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties Soaps, and syndet bars. Evolution and skin benefits.

UNIT V

Oily and dryskin, causes leading to dryskin, skin moisturisation. Basic understanding of the terms comedogenic, dermatitis. Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor. Antiperspirants and Deodorants- Actives and mechanism of action

SUGGESTED READINGS:

- 1) Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
- 2) Cosmetics Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
- 3) Text book of cosmelicology by Sanju Nanda & Roop K. Khar, Tata Publishers.

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