Bharath
INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(Declared as deemed to be university under section 3 of UGC Act 1956, vide notification No.F.9-5/2000-U.3)

FACULTY OF ENGINEERING AND TECHNOLOGY

REGULATIONS 2015

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CURRICULUM & SYLLABUS

CHOICE BASED CREDIT SYSTEM

B. TECH – INDUSTRIAL BIO TECHNOLOGY

(FULL TIME)

I-VIII SEMESTERS

DEPARTMENT OF INDUSTRIAL BIO TECHNOLOGY

BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY

NO: 173, AGARAM ROAD, SELAIYUR,

CHENNAI -600 073, TAMIL NADU

FACULTY OF ENGINEERING AND TECHNOLOGY

REGULATIONS 2015

CHOICE BASED CREDIT SYSTEM

DEGREE OF BACHELOR OF TECHNOLOGY

(EIGHT SEMESTERS)

(Applicable to the batches admitted from July 2015)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i. "**Programme**" means Degree Programme, that is B.Tech. Degree Programme.

ii. "**Discipline**" means specialization or discipline of B.Tech. Degree Programme, like Civil Engineering, Electrical and Electronics Engineering, information Technology, etc.

iii. "**Course**" means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics etc.

iv. **"Head of the Institution"** means the Dean of the Institution who is responsible for all academic activities of that College/Institution and for implementation of relevant rules of these Regulations.

v. **"University"** means Bharath Institute of Higher Education & Research (BIHER)

2.0 PREAMBLE

The 'Outcome Based Education (OBE)' Process is introduced to ensure that the required outcomes (knowledge, skills and attitude / behavior) are acquired by the learners of a programme. With the OBE process in mind, our educational system for the Faculty of Engineering and Technology has been framed to provide the needful scope for the learners through the Choice Based Credit System (CBCS) that will pave the path to strengthen their knowledge, skills and attitude / behavior. The CBCS offers flexibility to learners which include large number of electives, flexible pace for earning credits and audit courses.

2.1 THE OBJECTIVES OF CHOICE BASED CREDIT SYSTEM (CBCS) :

- To offer the right blend of Core, Humanities & Social Sciences, Engineering Sciences and Basic Science courses to facilitate the learners to acquire the needful outcomes.
- To facilitate students to choose open electives of their choice to acquire knowledge in the areas of their interest.
- To elevate the level of knowledge, skills and attitude/behavior on par with the students across the globe.

- To offer programmes in an open student centric environment with purpose, needful foundations, breadth (exposure for optimal learning) and professionalism.
- To learn at students' own pace
- To opt for additional courses and achieve more than the required credits
- To opt for interdisciplinary approach for learning
- To opt for Inter college/University migration within the country and outside with transfer of Credits.
- To have more scope to enhance students skills and more scope of taking up projects and assignments, vocational training, including entrepreneurship.
- To improve the job opportunities of students
- To enable potential employers assess the performance of students on a scientific scale.

The curriculum and syllabi for B.Tech programmes confirm to outcome based teaching-learning process based on the following Programme Educational Objectives.

2.2 PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: PREPARATION:
To provide strong foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems in the chosen field of Engineering and Technology.

PEO2: CORE COMPETENCE:
To enhance the skills and experience in defining problems in the appropriate field of Engineering and Technology, designing, implementing, analyzing the experimental evaluations, and finally making appropriate decisions.

PEO3: PROFESSIONALISM:
To enhance their skills and embrace new thrust areas through self-directed professional development and post-graduate training or education.

PEO4: SKILL:
To provide Industry based training for developing professional skills and soft skills such as proficiency in languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

PEO5: ETHICS:
Apply the ethical and social aspects of modern Engineering and Technology innovations to the design, development, and usage of new products, machines, gadgets, devices, etc.

In general the following Program Outcomes have been identified and the curricula have been structured in such a way that each of the courses meets these outcomes. The

Programme Educational Objectives and Programme Outcomes are well defined and aligned with the Vision and Mission of each of the Department and the University.

2.3 PROGRAMME OUTCOMES (POs)

Engineering Graduate will have

a) The ability to apply knowledge of mathematics, science, and engineering fundamentals.

b) The ability to identify, formulate, and solve engineering problems

c) The ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d) The ability to design and conduct experiments, as well as to analyze and interpret data

e) The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

f) The ability to apply reasoning informed by the knowledge of contemporary issues

g) The ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

h) The ability to understand professional and ethical responsibility and apply them in engineering practices

i) The ability to function on multidisciplinary teams

j) The ability to communicate effectively with the engineering community and with society at large

k) The ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.

l) The ability to recognize the need for, and an ability to engage in life-long learning

3.0 ADMISSION

3.1 Candidates seeking admission to the first semester of the eight semester B.Tech. Degree Programme: shall have passed the Higher Secondary Examinations of (10+2) Curriculum (Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III for Engineering group of courses and Physics, Chemistry and Biology for Bio group of courses (Industrial Bio Tech, Bio-Informatics, Genetic Engg and Bio-Medical Engg) or any examination of any other University or authority accepted by the Board of Management of University as equivalent thereto.

3.2 The candidates who have passed the Higher Secondary Examination (Vocational groups in Engineering/Technology) of the Government of Tamil Nadu, shall also be eligible for admission to the first 1^{st} year programme.

3.3 The candidates who have passed the Diploma in Engineering / Technology, after passing 10^{th} standard of school education conducted by the State Board of Technical Education and

training, shall be eligible for admission through Lateral entry system to the third semester of the B.Tech. Degree Programmes

3.4 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Board of Management of University and UGC from time to time

4.0 STRUCTURE OF PROGRAMMES

4.1 Every Programme will have curricula with syllabi consisting of theory and practical courses.

The curriculum is structured to achieve the Programme Educational Objectives (PEOs) and the corresponding Programme Outcomes (POs).

4.2 The syllabus for each course is designed based on Course Objectives and Course Outcomes (COs). COs are mapped with the POs in order to ensure the respective PO

4.3 Outline of Choice Based Credit System:

a. **Humanity and Social Studies:** Generally a course in language, value education, Personality Development, Environmental Sciences and Ethics.

b. **Basic Sciences:** Foundation courses like Maths, Physics, Chemistry, and Biology required to understand the Engineering Courses.

c. **Engg Sciences:** Foundation courses like Basic Civil, Mechanical, Electrical, Electronics, Computer and Cell Biology to lay foundation to understand the core and other allied engineering & technology courses.

d. **Professional Core Courses:** Courses which should compulsorily be studied by a candidate as core requirement are termed as Professional Core courses.

e. **Core Elective Courses:** Generally a course which can be chosen from a pool of courses for specializing in a specific area within the discipline/domain of the core curriculum.

f. **Non Major Elective Courses:** a course which can be chosen from a pool of courses supportive to the discipline or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill.

g. **Open Elective Courses:** a course that would improve his/her employability such as advanced technology courses offered by the industries or a course which the student thinks that would add value for his/her career.

h. **Projects & Research:** Project work/Dissertation and Term paper, Internship, Technical Seminar and Comprehension.

Course Work – Subject Area	Credits		Suggested Distribution of Credits
	Minimum	Maximum	
Humanities and Social Sciences(HSS): Soft skills, Value Education & Professional Ethics,	19	21	20

Languages, Environmental Science, Aptitude, Personality Development, NCC/NSS/NSO/ Yoga etc			
Basic Sciences(BS): including Maths, Physics, Chemistry and Biology,	28	31	29
Engineering Sciences (ES): Basic Civil Engg, Electrical Engg, Mechanical Engg, Electronics Engg, Computer, etc.	18	20	18
Professional Core (PC) & Core Electives (CE): subjects under Core Engg, relevant to the chosen specialization/branch	100	104	100
Non Major and Open Electives (NE & OE): relevant to the chosen specialization/branch, other Technical, emerging subject areas, etc.	15	15	15
Project Work & Research (PR): includes Project work, Term Paper, Seminar and/or internship in industry or elsewhere, etc.	13	17	15
Total credits for whole programmes:	174	208	197 (195-200) credits

4.4 The details of credit allocation are given below in the **Table**

Nature of the Course	Periods / Hours per Week	Credits
Theory	3	3
	4	4
Laboratory	2 or 3	1
Theory + Laboratory	2 + 2	3
Tutorial	2	1
Mini Project1	2	1
Term Paper	4	2
Tech Seminar/Industrial Training (2 weeks)	2	1
Project Work (Eighth Semester)	18 (Minimum)	9

Mini project, Technical Seminar and Industrial Training are also given 1 to 2 credits depending on the amount of time allotted based on the specific requirement of the branch concerned.

4.5 Each semester curriculum shall normally have a blend of theory courses not exceeding **7** and practical courses not exceeding 4. The students are permitted to register for a minimum of 16 credits and maximum of 30 credits in a semester.

4.6 For the award of the degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. The minimum will be between 195-200 credits depending on the branch of study.

4.7 The medium of instruction, examinations and project report will be English, except for courses on language other than English.

5.0 DURATION OF THE PROGRAMME:

4.1 The minimum period for completion of the B.Tech Programmes for HSC (or equivalent) candidates shall be eight (8) semesters/four (4) years and a maximum period of twelve (12) semesters/ six (6) years.

4.2 The minimum period for completion of the B.Tech Programmes (Lateral Entry) shall be eight (6) semesters/three (3) years and a maximum period of twelve (10) semesters/ five (5) years.

4.3. In exceptional circumstance a further extension of two more semesters/one year shall be granted. During the extended period the student shall be considered as a private candidate and also not be eligible for ranking.

4.4 Each semester shall normally consist of 90 working days with 450 hours. The Head of the Institution shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught. End –Semester Examination will ordinarily be at the end of each semester.

6.0 ATTENDANCE REQUIREMENTS FOR COMPLETION OF THE SEMESTER

6.1 A Candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester:

6.1.1. Every student is expected to earn at least 75% attendance.

6.1.2 However, a candidate who could secure attendance between 65% and 74% only in one particular semester due to medical reasons (hospitalization / accident / specific illness) is given exemptions of 10% of attendance on production of Medical Certificate.

6.1.3 Students who go for participating in Seminar or Conference will be given on duty permission. The candidate shall submit the on duty participation certificate to the HOD who will in turn recommend and submit to the Head of the Institution for the approval. The approved certificates will be forwarded to the Controller of Examinations for record.

6.2 Candidates who do not satisfy the clauses 6.1.2 and 6.1.3 will not be permitted to write the End-Semester Examinations of the subject and are not permitted to go to the next semester, the detained semester should be repeated in the next academic year. When a student fulfills the requirement of overall attendance in a semester as per the clause 6.1.2 and 6.1.3 but fails to fulfill the attendance requirement for some of the courses, such courses should be repeated in the next academic year when offered.

7.0 CLASS ADVISOR AND STUDENT COUNSELOR

7.1 Class Advisor

Head of the Department will allot one faculty member to each class as class advisor. The role of the class advisor is to

i. Monitor the attendance of the class,

ii. Class work done by the faculty,

iii. Circulate the notices and circulars pertaining to the class, class time table, test schedule, examination time table, meeting schedule, minutes of the class committee meetings, etc.,

iv. Maintain all important documents of the students for reference/inspection by all committees

iv. Work closely with the student counselors on matters related to students attached to the student counselor and update the students record of the students of the class..

7.2 Student Counselor (Mentor)

HOD will assign a Student Counselor (Mentor) for every 15 students at the time of admission in the first semester who will continue to be the mentor for these students till they graduate. By guiding and counseling students, teachers can create a greater sense of belongingness amongst our student community. The student counselor will monitor the courses undertaken by the students, check attendance and progress of the students and counsel them periodically. The student counselors should ensure that each student is made aware of the various options for growth and are monitored and guided to become overall performers and help the students to select and work for career choices of their interest. The student counselors shall update and maintain the record of each student attached to them. The student counselors shall also help the class advisors to update the record card of students attached to them. The student counselor may also discuss with the class advisor and HOD and parents about the progress of the students.

8.0 CLASS COMMITTEE

There shall be a class committee for each class in a semester.

8.1 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 of the first semester (generally common to all branches), the class committee is to be constituted by the first year class coordinator.

8.2 The class committee shall be constituted on the first working day of any semester or earlier.

8.3 At least 4 student representatives (usually 2 boys and 2 girls) shall be included in the class committee.

8.4 A class committee will consists of teachers of the concerned class, student representatives, class advisor, student counselors and a chairperson who is not normally teaching the class,. The function of the class committee include

- Solving problems experienced by students in the class room and in the laboratories.
- Clarifying the regulations of the degree programme and the details of rules
- 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 the problems, if any.
- The committee shall device suitable methods for improving the performance of slow learners identified.

8.5 The Head of the Institution may participate in any class committee of the institution.

8.6 The chairperson is required to prepare the minutes of every meeting, submit the same to Head of the Institution within two days of the meeting and arrange to circulate it among the concerned students and teachers. If there are some points in the minutes requiring action by the institution, the same shall be brought to the notice of the Head of the Institution by the chairperson of the class committee through respective HODs.

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 or three subsequent meetings may be held at suitable intervals. During these meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

9.0 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 teaching the common course with one of them nominated as Course Coordinator. The nomination of the Course Coordinator shall be made by the Head of the Department / Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The 'Course committee' shall meet as often as possible and ensure uniform scheme of evaluation for the test. Wherever it is feasible, the course committee may also prepare a common question paper for the test(s).

10.0 PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

10.1 Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the Head of the department periodically (at least three times in a semester) for checking the syllabus coverage and the records of test marks and attendance. The Head of the department will put his/her signature and date after due verification. At the end of the semester, the record should be verified by the Head of the Institution who will keep this document in safe custody (for two years). Any inspection team appointed by the University may inspect the records of attendance and assessment of both current and previous semesters.

10.1.1 The marks allocated for attendance is given in **Table .**

% of Attendance	**Marks**
<75	Nil
76-80	1
81-85	2
86-90	3
91-95	4
96-100	5

10.2 Theory Courses

There will be two periodical tests, each carrying weightage of 5 marks and one model examination carrying weightage of 10 marks. The distribution of marks for various components for the Internal Assessment is shown below in the table:

S.No	**Components for Internal Assessment**	**Syllabus Coverage for the test / exam**	**Duration of the test in Minutes.**	**Marks (max.)**
01.	Internal Test – I	2 Units of the Syllabus	90	5
02.	Internal Test – II	Next 2 Units of the Syllabus	90	5
03	Model Test	Full Syllabus	180	10
04	Seminar/Assignment/ Online Test/Quiz	-	-	5

06.	Attendance (Refer Clause 10.1.1)	-	-	5
Total				**30**

10.3 Practical Courses:

Every practical exercise / experiment in all practical courses will be evaluated based on the conduct of exercise / experiment and records maintained by the students. There will be at least **one** model practical examination.

The criteria for awarding marks for internal assessment are given in **Table below.**

Items	Marks (Maximum)
Observation	**7.50**
Record	**7.50**
Model Practical	**20**
Attendance { Refer – 10.1.1 }	**5**
Total	**40**

10.4 Project Work

Project work may be assigned to a single student or to a group of students not exceeding 4 per group. For Project work out of 100 marks, the maximum marks for Continuous Assessment is fixed as 40. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of 3 members in the review committee. The project Guide will be one of the members of the Review Committee.

There shall be two assessments (each 100 marks) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The total marks obtained in the two assessment shall be 40 marks

The continuous assessment marks for Project Work will be distributed as given below:

Continuous Assessment 40 Marks			
Review I (20 Marks)		Review II (20 Marks)	
Review Committee (excluding guide)	Guide	Review Committee (excluding guide)	Guide
14	6	14	6

10.5 Seminar / Professional Practices:

The seminar / Professional Practices shall carry 100 marks and shall be evaluated through continuous assessment only. Every student is expected to present a minimum of 2 seminars per semester before the evaluation committee and for each seminar, marks can be equally apportioned. The three member committee appointed by the Head of the Department will evaluate the seminar and at the end of the semester the marks can be consolidated and taken as the final mark. The evaluation shall be based on the seminar paper / report (40%), presentation (40%) and response to the questions asked during presentation (20%).

10.6 Industrial / Practical Training / Internship / Mini Project

The Industrial / Practical Training shall carry 100 marks and shall be evaluated through continuous assessment only. At the end of Industrial / Practical training / internship / Summer Project, the student shall submit a brief report on the training undergone and a certificate from the organization concerned. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Department. Certificates (issued by the Organization) submitted by the student shall be attached to the mark list and sent to the Controller of Examinations by the Head of the Department.

10.7 Term Paper

i. The students shall carry out this course under the guidance / supervision of a faculty. The "Term Paper" course is individual based.

ii. For the Term Paper course out of 100 marks, the maximum marks for Continuous Assessment is fixed as 40. The Head of the Department shall constitute a review committee for this course. There shall be two reviews and each review carries 20 marks. Every student is expected to identify a topic with substantial literature survey and the technological development of the topic and should submit a report by end of the semester and the students should also prepare a paper on the subject matter of the Term Paper and submit the same to some journal for publication or to a conference for presentation.

iii. At the end of the semester a viva-voce examination will be conducted by an external, internal examiners and the guide on the term paper report submitted by the students. The report evaluation and Viva Voce shall carry a max mark of 30 marks and the paper prepared for the publication shall carry a max mark of 30 based on the quality.

10.8 Comprehension

The comprehension course is offered as two different courses, one in the V semester and the other in the VIII semester, each carrying one credit. The comprehension courses are evaluated by Viva-Voce examination on the subjects studied till that semester of assessment.

10.9 Massive Open Online Course (MOOC)

The students are permitted to opt for Massive Open Online Course(s) listed in the UGC website or any other Organisation or Institution either within India or Abroad as Open Elective with 3 credits. The Assessment method if specified any for the respective course in the web site or as standard procedure followed for any theory course as per the regulation shall be followed.

11.0 END SEMESTER EXAMINATIONS:

11.1. Theory Courses

The examinations shall ordinarily be conducted between October and December during the odd semesters and between April and June in the even semesters The End Semester Examination question paper pattern is given below:

Syllabus Coverage	Duration of the Exam in Hours	Question Pattern
Full Syllabus	3	**Part – A, 10x2 = 20** Short answer Type, 10 questions each carrying 2 marks. 2 questions from each unit. **Part – B, 5x6 = 30** Para /Analytical Type, 5 questions, one from each unit EITHER - OR type. **Part – C, 5x10 = 50** Essay/Design/Analytical Type, 5 questions out of 7 covering the full syllabus
		Max mark = 100

However, the question paper pattern for courses in engineering graphics and machine drawing may be designed differently to suit the specific needs of the courses.

11.2. Practical Courses

End Semester examination for practical courses will be conducted jointly by one internal examiner and one external examiner appointed by the Controller of Examinations with the recommendation of the Head of the Dept.

11.3. The maximum marks for each theory shall be 100 comprising of 30 marks for internal assessment and 70 marks for the end semester examinations conducted by the University.

The maximum marks for each practical course (including the project Work and Viva Voce Examination in the Eighth Semester) shall be 100 comprising of 40 marks for internal assessment and 60 marks for the end semester examinations conducted by the University.

11.4 PROJECT WORK

The student(s) is expected to submit the project report on or before the last working day of the semester. The University examination for the project work shall consist of evaluation of the final project report submitted by the student or students of the project group by an external examiner followed by a viva-voce examination conducted separately for each student by a committee consisting of an external examiner and an internal examiner. The Controller of Examinations shall appoint Internal and External Examiners from the panel of examiners recommended by the Head of the Department for the End Semester Examinations of the Project Work.

The End Semester Examination marks for the Project Work and for the Viva-Voce Examination will be distributed as given below.

End Semester Examination 60 Marks		
Report Evaluation (20 Marks)	Viva – Voce (40 Marks)	
External Examiner	External Examiner	Internal Examiner
20	20	20

If the project report is not submitted on or before the specified deadline, an extension of time up to a maximum of 30 days may be given for the submission of project work with due approval obtained from the Head of the Department. If the project report is not submitted even beyond the extended time then the student(s) is deemed to have failed in the Project Work. The failed student(s) shall register for the same in the subsequent semester and repeat the project work again.

12.0 SUPPLEMENTRY EXAMINATIONS

After the publication of eighth semester results, supplementary examinations will be conducted to the students who have failed in any of theory courses in any of the semesters with no arrears in the practical Examinations. Interested students should register for the examinations required by them. Controller of examination will schedule supplementary examinations after the last date of registering for the supplementary examinations.

Pattern of evaluation will be the same as that of the end semester examinations. For non theory examinations supplementary examinations are not applicable.

13.0 MALPRACTICE

If a student indulges in malpractice in any internal test/model examination/end semester

examination, he/she shall be liable for punitive action as recommended by the Malpractice committee.

14.0 REQUIREMENTS FOR APPEARING FOR UNIVERSITY EXAMINATIONS

A candidate shall normally be permitted to appear for the semester Examinations of the current semester if he/she has satisfied the semester completion requirements (Vide Clause 6.0) and has registered for examination in all courses of the semester

15.0 PASSING REQUIREMENTS

15.1 A candidate who secures not less than 50% of total marks earned in the internal and end semester examination put together in theory course or practical courses or project work shall be declared to have passed the examination in that course.

15.2 If a candidate fails to secure a pass in a particular course, it is mandatory that he/she shall register and reappear for the examination in that course during the subsequent semester when examination is conducted in that course; he/she should continue to register and reappear for the examinations till he / she secures a pass. However the internal assessment marks obtained by the candidate in the first attempt shall be retained and considered valid for all subsequent attempts. In exceptional cases, a candidate may be permitted by the Head of the Institution to redo the courses for improving the internal assessments marks.

16.0. METHODS FOR REDRESSAL OF GRIEVANCES IN EVALUATION

16.1. Students who are not satisfied with the grades awarded can seek redressal by the methods given in the Table below:

Redressal Sought	Methodology
Request for photocopy of the answer script and or request for revaluation	To apply to COE within 7 days of declaration of the result/within 7 days of obtaining the photocopy along with the payment of the prescribed fee.

These are applicable only for theory courses in regular and arrear end semester examinations.

16.2 Challenge of Evaluation

If one is not satisfied with the result, can make an appeal to the CoE for the review of answer scripts after paying the prescribed fee within 7 days after the declaration of the examination result/revaluation result.

17.0 AWARD OF LETTER GRADES

All assessments of a course will be done on absolute marks 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 as detailed below:

Range of total marks	Letter Grade	Grade points
90-100	S	10
80-89	A	9
70-79	B	8
60-69	C	7
55-59	D	6
50-54	E	5
0 to 49	U	0
Incomplete	I	0
Withdrawal	W	0

"U" denotes failure in the course.

"I" denotes incomplete as per clause 6.0 and hence prevention from writing End-Semester examination.

"W" denotes withdrawal from the course.

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

The list of courses enrolled during the semester and the grade scored.

The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA for a semester is the ratio of the sum of the products of the number of credits for courses acquired and the corresponding grade points 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 = Sum of (C*GP)/Sum of C

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. "U", "I" and "W" grades will be excluded for calculating GPA and CGPA.

18.0 ELIGIBILITY FOR THE AWARD OF THE DEGREE

A student shall be declared to be eligible for the award of the B.Tech Degree provided the student has

18.1 Successfully completed the course requirement and has passed all the prescribed examinations in all the 8 semesters (6 semesters for lateral entry) within a maximum period of 7 years (6 years for lateral entry) reckoned from the commencement of the first semester to which the candidate was admitted.

18.2 No disciplinary action is pending against him/her.

18.3 The award of the degree must be approved by the Board of Management of the University.

19.0 CLASSIFICATION OF THE DEGREE AWARDED

19.1 A candidate who qualifies for the award of the degree (vide clause 18.0) having passed examination in all the courses of all the eight (8) semesters (six (6) semesters in the case of lateral entry) in his/her First Appearance within eight (8) consecutive semesters (six (6) consecutive semesters for lateral entry) and securing a CGPA of not less than 8.0 shall be declared to have passed the examination in **first class with distinction**. For this purpose the withdrawal from examination (vide clause 20.0) will not be construed as an appearance. Further authorized break of study (vide clause 21.3) will not be counted for the purpose of classification.

19.2 A candidate who qualifies for the award of the degree (vide clause 18.0) having passed the examination in all the courses within a maximum period of twelve (12) semesters (ten (10) semesters for lateral entry) and securing a CGPA of not less than 6.50 shall be declared to have passed the examination in **First Class**. For this purpose the authorized break of study (vide clause 21.3) will not be counted for the purpose of classification.

19.3 All other candidates (not covered in clauses 19.1 and 19.2) who qualify for the award of the degree (vide Clause 18.0) within a maximum period of twelve (12) semesters (ten (10) semesters for lateral entry) shall be declared to have passed the examination in **Second Class**.

19.4 All other candidates (not covered in clauses 19.1, 19.2 & 19.3) who qualify for the award of the degree during the extended period as per the clause 4.2 shall be considered as a private candidate and also not be eligible for ranking and they shall be eligible to get only a **pass** certificate.

19.5 A candidate who is absent in semester examination in a course / project work after having registered for the same shall be considered to have appeared in that examination for the purpose of classification.

20.0 PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

20.1 A candidate may for valid reasons be granted permission to withdraw from appearing for the examination of only any one semester examination during the entire duration of the degree programme. Also only one application for withdrawal is permitted for that semester examination in which withdrawal is sought.

20.2 Withdrawal application shall be valid only if the candidate is otherwise eligible to write examination and if it is made within the prescribed number of days prior to the

commencement of the examination in that course or courses and also recommended by the Head of the Department and the Head of the Institution.

20.3 A candidate for valid reasons like sudden illness or accident or unexpected natural calamities not able to be present in the examination hall in time or absent for the examination may seek post permission for the withdrawal from the examination.

20.4 Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction.

21.0 TEMPORARY BREAK OF STUDY FROM A PROGRAMME

21.1 A candidate is not normally permitted to temporarily break the study. However, if a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons (such as accident or hospitalization due to prolonged ill health) and to rejoin the programme in a later semester he / she apply to the Head of the Institution in advance, in any case, not later than the last date for registering for the semester in question, through the Head of the Department stating the reasons thereof.

21.2 The candidates permitted to rejoin the programme after break of study shall be governed by the rules and regulation in force at the time of rejoining.

21.3 The duration specified for passing all the courses for the purpose of classification (vide clause 19.1 and 19.2) shall be increased by the period of such break of study permitted.

21.4 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.0 irrespective of the period of break of study in order that he/she may be eligible for the award of the degree (vide clause 18.0).

21.5 If any student is detained for want of required attendance, progress and good conduct, the period spent in that semester shall be considered as permitted 'Break of study' and clause 21.3 is not applicable for this case.

22.0 INDUSTRIAL VISIT

Every student is required to undergo one Industrial visit in every semester starting from the third semester of the Programme arranged by the Head of the Department.

23.0 FAST TRACK PROGRAMME

Fast track programme is introduced as an option for the bright students enabling them to complete the course in a short duration.

23.1 Eligibility

Those students who have secured CGPA of 9 and above at the end of 2nd semester are eligible to opt for the fast track scheme.

23.2 Structure of the Fast Track Scheme

The curriculum is framed in such a way that the eligible students who opt for fast track scheme will be able to complete the degree course in a period of three years. There will be

two summer terms conducted one after the 2nd semester and another after the 4th semester during the summer vacations. Each summer term will a have maximum of three theory courses and two laboratory practical courses. However, the total number of credits to be earned for the award of degree will remain the same as that of the concerned regular programme.

24.0 MIGRATION/TRANSFER OF CANDIDATES

24.1 Migration/Transfer of candidates from another University approved by UGC shall be granted.

24.2 All Migrations/Transfers are subject to the approval of the Vice Chancellor

25.0 DISCIPLINE

Every student is required to observe disciplined and decorous behavior both inside and outside the Institute and not to indulge in any activity which will tend to bring down the prestige of the University/Institute. The Dean shall constitute a disciplinary committee consisting of Dean, Head of the departments to which the student concerned belongs, and the Head of another department to enquire into acts of indiscipline and notify the University about the disciplinary action recommended for approval.

26.0 REVISION OF REGULATIONS AND CURRICULUM

The University may from time to time revise, amend or change the Regulations, Curricula, Syllabi and scheme of examinations through the Academic Council with the approval of Board of Management.

CURRICULUM AND SYLLABUS (R2015)

CHOICE BASED CREDIT SYSTEM

B.TECH – INDUSTRIAL BIO TECHNOLOGY

I – VIII SEMESTERS

SEMESTER I							
SL NO	**SUB.CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1.	BEN101	HS	English – I	3	1	0	3
2.	BMA101	BS	Mathematics - I	3	1	0	3
3.	BPH101	BS	Engineering Physics - I	3	0	0	3
4.	BCH101	BS	Engineering Chemistry - I	3	0	0	3
5.	BBT101	ES	Cell Biology	2	1	0	3
6.	BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
7.	BSS101	HS	Personality Development	1	1	0	2
8.	BCE101	ES	Basic Civil Engineering	2	0	0	2
9.	BME103	ES	Basic Mechanical Engineering	2	0	0	2
PRACTICAL							
10.	BCM1L1	ES	Basic Civil and Mechanical Engineering Practices Laboratory	0	0	3	1
11.	BCS2L2	ES	Computer Practices Lab	0	0	3	1
12	BPC1L1	BS	Physics and Chemistry Laboratory#	0	0	3/3	0
13	BSS1L4/ BSS1L5/ BSS1L6	HS	NCC/ NSS/ NSO (to be conducted during weekends)				1
Total Instruction Periods per week=35						**Total No. of Credits = 27**	
# Laboratory Classes on alternate weeks for Physics and Chemistry. The Lab examinations will be held only in the second semester (including the first semester experiments also)							

SEMESTER II							
SL. NO	**SUB. CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1.	BEN201	HS	English – II	3	1	0	3
2.	BMA201	BS	Mathematics - II	3	1	0	3
3.	BPH201	BS	Engineering Physics - II	3	0	0	3
4.	BCH201	BS	Engineering Chemistry – II	3	0	0	3
5.	BCS201	ES	Internet Programming	2	0	0	2
6.	BFR201*	HS	Foreign / Indian Language	3	0	0	3
7.	BBT201	ES	Principles of Genetics	2	0	0	2
8.	BEE201	ES	Basic Electrical and Electronics Engineering	2	0	0	2
PRACTICAL							
9.	BCS2L1	ES	Internet Practices Lab	0	0	3	1
10.	BEE2L1	ES	Basic Electrical and Electronics Engineering Practices Laboratory	0	0	3	1
11.	BPC2L1	BS	Physics and Chemistry Laboratory#	0	0	3/3	1
12	BSS1L7	HS	Yoga	0	0	2	1
Total Instruction Periods per week=34				**Total No. of Credits = 25**			

*Any one of the following courses: BFR201 – French, BGM201-German, BJP201 – Japanese, BKR201 – Korean, BCN201 – Chinese, BTM201 – Tamil**.**

Laboratory Classes on alternate weeks for Physics and Chemistry. The Lab examinations will be held only in the second semester (including the first semester experiments also)

SEMESTER III						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BBT304	PC	Waste Management Technology	3	0	0	3
BBT306	PC	Principles of Chemical	4	0	0	4
BBT307	PC	General Biochemistry	3	0	0	3
BBT308	PC	General Microbiology	3	0	0	3
BBT309	PC	Instrumentation for Biotechnology	3	0	0	3
BBT310	PC	Immunology	3	0	0	3
PRACTICAL						
BBT3L3	PC	Biochemistry Lab	0	0	3	2
BBT3L2	PC	Instrumental Methods of Analysis	0	0	3	2
BBT3L1	PC	Cell Biology Lab	0	0	3	2
TOTAL HOURS : 28			**CREDITS : 25**			

SEMESTER IV						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BBT401	PC	Bioorganic chemistry	3	0	0	3
BBT403	PC	Introduction to Industrial Biotechnology	3	0	0	3 3
BBT404	PC	Principles of Chemical	4	0	0	4
BBT405	PC	Unit Operations	4	0	0	4
BBT406	PC	Introduction to Molecular biology	3	0	0	3
BCE406	HS	Environmental studies	3	0	0	3
PRACTICAL						
BBT4L1	PC	Microbiology Lab	0	0	3	2
BBT4L2	PC	Bioorganic chemistry Lab	0	0	3	2
BBT4L3	PC	Molecular Biology Lab	0	0	3	2
BBT4S1	PR	Technical Seminar I	0	0	2	1
TOTAL HOURS : 31			**CREDITS: 27**			

SEMESTER V						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BMA501	BS	Biostatistics	4	0	0	4
BBT501	PC	Genetic Engineering	3	0	0	3
BBT502	PC	Principles of Bioprocess	3	0	0	3
BBT503	PC	Chemical Reaction Engineering	4	0	0	4
BBT505	PC	Plant Biotechnology	3	0	0	3
	CE	Core Elective -I	3	0	0	3
PRACTICAL						
BBT5L1	PC	Genetic Engineering Lab	0	0	3	2
BBT5L2	PC	Chemical Engineering lab	0	0	3	2
BBT5L3	PC	Plant & Animal Biotechnology Lab	0	0	3	2
BBT5C1	PR	Comprehension - I	0	0	0	1
TOTAL HOURS : 29CREDITS : 27						

SEMESTER VI						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BBT601	PC	Animal Biotechnology	3	0	0	3
BBT602	PC	Enzyme Engineering and Technology	3	0	0	3
BBT603	PC	Environmental Biotechnology	3	0	0	3
BSS601	HS	Value Education and Professional ethics	3	0	0	3
	CE	Core Elective-II	3	0	0	3
	NE	Non Major Elective I	3	0	0	3
PRACTICAL						
BBT6L1	PC	Bioprocess Engineering Lab I	0	0	3	2
BBT6L2	PC	Environmental Biotechnology Lab	0	0	3	2
BBT6L3	PC	Immuno technology Lab	0	0	3	2
BBT6P1	PR	Mini Project	0	0	4	2

TOTAL HOURS:31		CREDITS: 26				
SEMESTER VII						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BBT701	PC	Research Methodology and Instrumentation	3	0	0	3
BBT703	PC	Down Stream processing	3	0	0	3
BBT705	PC	Bioprocess Engineering	3	0	0	3
	CE	Core Elective III	3	0	0	3
	NE	Non Major Elective II	3	0	0	3
	OE	Open Elective I	3	0	0	3
PRACTICAL						
BBT7L1	PC	Bioprocess Engineering Lab II	0	0	3	2
BBT 7L2	PC	Downstream processing Lab	0	0	3	2
BBT7P1	PR	Term Paper	0	0	4	2
BBT7V1	PR	In-plant Training Note: Students to get trained in an industry for a period of two weeks at the end of VI semester)	0	0	0	1
TOTAL HOURS:28			**CREDITS: 25**			

SEMESTER VIII						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
	OE	Open Elective –II	3	0	0	3
	NE	Non Major Elective III	3	0	0	3
PRACTICAL						
BBT8C1	PR	Comprehension – II	0	0	0	1
BBT8P1	PR	Project work	0	0	18	9
TOTAL HOURS:24			**CREDITS: 16**			

OVERALL CREDITS = 198

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	6	7	-	3	-	3	-	-	19	9.60
2	Basic Sciences (BS)	9	10	-	-	4	-	-	-	23	11.62
3	Engineering Sciences (ES)	12	8	-	-	-	-	-	-	20	10.10
4	Professional Core (PC)	-	-	25	23	19	15	13	-	95	47.98
5	Core Electives (CE)	-	-	-	-	3	3	3	-	9	4.55
6	Non major Electives (NE)	-	-	-	-	-	3	3	3	9	4.55
7	Open Electives (OE)	-	-	-	-	-	-	3	3	6	3.03
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	-	1	1	2	3	10	17	8.59
	Total Credit	27	25	25	27	27	26	25	16	198	100
	Total Contact Hour	35	34	28	31	29	31	28	24	240	

LIST OF ELECTIVES

CORE ELECTIVE(CE) I					
BBTE01	Food Process Technology	3	0	0	3
BBTE02	Cancer biology	3	0	0	3
BBTE03	Bioreactor design	3	0	0	3
CORE ELECTIVE(CE) II					
BBTE04	Dairy Technology	3	0	0	3
BBTE05	Medical biotechnology	3	0	0	3
BBTE06	Bioprocess Economics& Plant Design	3	0	0	3
CORE ELECTIVE(CE) III					
BBTE07	Food safety and quality control	3	0	0	3
BBTE08	Stem cell and Tissue Engineering	3	0	0	3
BBTE09	Biosensor Technology	3	0	0	3
NON MAJOR ELECTIVE(NE) I					
BBTE10	Proteogenomics and Bioinformatics	3	0	0	3
BBTE11	Alternate energy	3	0	0	3
BBTE12	Developmental Biology	3	0	0	3
NON MAJOR ELECTIVE(NE) II					
BBTE13	Biopharmaceutical Technology	3	0	0	3
BBTE14	Biofuel Technology	3	0	0	3
BGE006	Biomedical Engineering	3	0	0	3
NON MAJOR ELECTIVE(NE) III					
BBTE15	Metabolic Engineering	3	0	0	3
BBA005	Energy Engineering Management	3	0	0	3
BBTE16	Nanobiotechnology	3	0	0	3
OPEN ELECTIVE(OE) I					
BCE057	Industrial Waste Treatment and Disposal	3	0	0	3
BBTE17	Engineering Optimization	3	0	0	3
BBA008	Total Quality Management	3	0	0	3
	NSS Paper I	2	0	2	3
OPEN ELECTIVE(OE) II					
BBA009	Intellectual Property Rights	3	0	0	3
BCE059	Environmental Health Engineering	3	0	0	3
BBTE18	Industrial Safety Engineering	3	0	0	3
BBTE19	Bio entrepreneurship Development	3	0	0	3
	NSS Paper II	2	0	2	3
	Massive Open Online Course	3	0	0	3

BEN101	ENGLISH - I	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Dept of English				

OBJECTIVES

To make the students learn the basic modes of communication for fluency and attainment of confidence in speech, reading and writing.

COURSE OUTCOMES (COs)

CO1	Understand the importance of being responsible, logical, and thorough.
CO2	Respond to the situations where short reports and instructions are required.
CO3	Explain "how things work", and what to suggest when "things don't work
CO4	Develop our confidence and authority in the practical use of language.
CO5	Understand the importance of being responsible, logical, and thorough.
CO6	Able to Face interviews and competitive examinations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H	H	H	H	H	M	L	L	H	H	H	H
	CO2							L					
	CO3	H						H		H			H
	CO4	H	M				M	L	H	H			H
	CO5							L					
	CO6	H		H	H	H	H	L		H	H	M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective	Open Elective (OE)	Project/ Term Paper/ Seminar/
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I STRUCTURES **12**

Parts of speech - Active and passive voices - Subject verb agreement. - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making

UNIT II TRANSCODING **12**

Cause and effect relations – Punctuations –Differences between verbal and nonverbal communication -E - mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart.

UNIT III REPORTING 12

Degrees of comparison – Positive, Comparative, Superlative - questions- SI units -Lab reports - Physics chemistry, workshop and Survey report for introducing new product in the market.

UNIT IV FORMAL DOCUMENTATION 12

Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review-Preparing minutes of the meeting, Agenda, official circulars.

UNIT V METHODOLOGY 12

Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives , prepositional relatives.

TEXT BOOK

1. Department Of Humanities and Social Sciences Division, Anna University, Oxford University Press, 2013.

REFERENCES:

1. S.P.Danavel, English and Communication for Students of Science and Engineering, Orient Blackswan, Chennai, 2011.
2. Rizvi, M.Asharaf, Effective Technical Communication, New Delhi, Tata McGraw Hill Publishibg Company, 2007.
3. Murali Krishna and Sunitha Moishra, Communication Skills for Engineers . Pearson, New Delhi, 2011.

BMA101	**MATHEMATICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – + 2 Level Mathematics				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

To make the students learn Mathematics in order to formulate and solve problems effectively in their respective fields of engineering.

COURSE OUTCOMES (COs)

CO1	Study the fundamentals of mathematics
CO2	Students learn multiple integral techniques
CO3	Students gain knowledge in application of variables
CO4	Find area and volume based on a function with one or more variables.
CO5	Apply matrix operations to solve relevant real life problems in engineering.
CO6	Formulate a mathematical model for three dimensional objects and solve

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	D	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2			M		H							
	CO3		H				M						
	CO4								L				
	CO5							H			L		
	CO6											L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT 1 MATRICES 12

Characteristic equations- Eigen values and eigen vectors of the real matrix- Properties- Cayley-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a Sphere- Plane section of a sphere- Tangent plane- Equation of cone- Right circular cone- Equation of a cylinder- Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes- Envelopes- Applications of Evolutes and Envelopes.

UNIT 1V FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives- Euler's theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions- Jacobians- Taylor's expansion- Maxima and Minima- Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates-Area as double integral- Volume as triple integral.

TEXT BOOK:

1. Ravish R.Singh and Mukkul Bhatt, "Engineering Mathematics-I" First Reprint, Tata McGraw Hill Pub Co., New Delhi. 2011.
2. Grewal.B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi. 2007.

REFERENCES:

1. Ramana.B.V. "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons, New York, 2003.
4. Murray R.Spiegel, "Advanced Calculus", Schaum's Outline Series, First Edn, McGraw Hill Intl Book Co.,New Delhi, 1981.

PH101	**ENGINEERING PHYSICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES:

To enhance the fundamental knowledge in Physics and its applications relevant to various stream Engineering and Technology

COURSE OUTCOMES (COs)

CO1	Understand the Principles and Laws of Physics
CO2	To understand the impact of Crystal Physics
CO3	Learn the Properties of Elasticity and Heat transfer.
CO4	Acquire Knowledge on Quantum Physics.
CO5	Understand the concepts on Laser & Ultrasonic's and its Applications
CO6	Understand the Principle of Laser and its Applications in Engineering and Medicine.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	A	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M			H		
	CO2		L	H		M				M		L	H
	CO3												
	CO4	H		M	L						L		M
	CO5		L	L								L	L
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CRYSTAL PHYSICS 9

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 – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity-Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion –Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO_2, Semiconductor lasers (homo junction & hetero junction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TEXT BOOKS:

1. Jayaraman D Engineering Physics I. Global Publishing House, 2014.
2. Arumugam M. Engineering Physics. Anuradha publishers, 2010.
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai Publishers, 2009.
4. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
3. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.

4. http://ocw.mit.edu/courses/find-by-topic
5. http://nptel.ac.in/course.php?disciplineId=122
6. https://en.wikipedia.org/wiki/Engineering_physics

BCH101	ENGINEERING CHEMISTRY - I	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level Chemistry				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Understand the principles of water characterization and treatment for portable and industrial purposes.
CO2	To impart knowledge on the essential aspects of Principles of polymer chemistry and engineering applications of polymers
CO3	Having a sound knowledge in the Field of the Conventional and non-Conventional energy
CO4	To impart knowledge on the essential aspects of electrochemical cells, emf and applications of EMF measurements
CO5	To make the students understand the Principles of corrosion and corrosion control .
CO6	To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	L
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I WATER TECHNOLOGY 9

Introduction-Characteristics : Hardness of water – types - temporary and permanent hardness - estimation by EDTA method Alkalinity – types of alkalinity - Phenolphthalein and Methyl orange alkalinity - determination –Domestic water treatment – disinfection methods (Chlorination, Ozonation , UV treatment) Boiler feed water – requirements – disadvantages of using hard water in boilers Internal conditioning (Calgon Conditioning method) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

UNIT II POLYMERS 9

Introduction-Polymers- definition – polymerization – degree of polymerization - types of polymerization– Addition polymerization and Condensation polymerization – Mechanism of Polymerization - free radical polymerization mechanism only, Plastics: Classification – thermoplastics and thermosetting plastics – difference between thermoplastics and thermosetting plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET, Rubber :Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III ELECTRO CHEMISTRY 9

Introduction CELLS: types of Electrochemical cells , Electrolytic cells – Reversible and irreversible cells EMF – measurement of EMF– Single electrode potential – Nernst equation Reference electrodes : Standard Hydrogen electrode -Calomel electrode Ion selective electrode :Glass electrode and measurement of pH using Glass electrode Electrochemical series – significance Titrations :Potentiometer titrations (redox - Fe^{2+}vs dichromate titrations) Conduct metric titrations (acid-base – HCI vs, NaOH titrations)

UNIT IV CORROSION AND CORROSION CONTROL 9

Introduction: Chemical corrosion Definition - Chemical Corrosion - Electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – mechanism of Chemical and Electrochemical corrosion factors influencing corrosion control – sacrificial anode and impressed cathodic current methods – Protective coatings :Paints– constituents of the paint and their functions Metallic coatings – electroplating of Gold and electro less plating of Nickel.

UNIT V NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Introduction : Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain Reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation (block diagram only) – breeder reactor Solar energy conversion – solar cells – wind energy Fuel cells – hydrogen – oxygen fuel cell Batteries :Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries :Lead–acid storage battery –working –uses Nickel–cadmium battery - working – uses Solid – state battery : Lithium battery

TEXT BOOKS:

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara “A text book of engineering chemistry” S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, “Engineering Chemistry, Volume 1”, Crystal Publications, Chennai, (2007).

REFERENCES :

1. B.K.Sharma “Engineering chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).

3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Electrochemistry

BBT 101	CELL BIOLOGY	L	T	P	C
	Total Contact Hours - 45	2	1	0	3
	Prerequisite – Higher Secondary level biology, basic concepts in cell signaling				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of cell, its structure, function, types and about its culture

COURSE OUTCOMES (COs)

CO1	To understand the fundamentals of the structure of cells
CO2	To study the types and functions of cell organelles
CO3	To comprehend the methods involved in the cellular transport
CO4	To know the cause, and methods of cell signaling
CO5	To give a basic knowledge of cell culture and its applications
CO6	To understand about signal transduction

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2				M								
	CO3	M											
	CO4							H				M	
	CO5	H											
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I: CELL STRUCTURE **9**

Cells-definition, Eukaryotic cell and prokaryotic cell – differences and key organelles, Relationship and evolution of Eukaryotic cell and prokaryotic cell, plant cells and animal cells–differences and general structure- Cellular environment, tissues, various types of cell, Extra cellular matrix, cytoskeletal proteins, Cell cycle-Mitosis and meiosis

UNIT II: CELL ORGANELLES **9**

Cell Organelles and function – Nucleus, Cytoplasm, Endoplasmic reticulum, Golgi complex, lysosomes, cell membranes, chloroplast, mitochondria – structure, importance and function

UNIT III: CELLULAR TRANSPORT 9

Transport across cell membranes – importance, classification – Active and passive, passive transport – movement of water, small lipid across membrane. Active – Na+ K+ ATPase Pump, Lysosomal and Vacuolar pumps. Cotransport – Symport, antiport – examples, Endocytosis and Exocytosis transport across prokaryotic membrance, entry of viruses and toxins

UNIT IV: CELL SIGNALING AND SIGNAL TRANSDUCTION 9

Cell signaling – process importance, various kinds of Receptors and ligands – Examples, Different modes of action of ligands, Qualification and characterization of receptors, different modes of signal transduction and amplification with examples, signaling through G-Proteins (Monomeric and trimeric), signaling for growth factors, second messengers, protein kinases, Ca ions and cAMP molecule in signaling.

UNIT V: CELL CULTURE 9

Definition, Media preparation, Propagation of eukaryotic and prokaryotic cell, cell lines, primary cultures, stock cell cultures, maintenance of cell lines in cell culture, explants cultures, differentiation and contamination

TEXT BOOKS:

1. P.K. Gupta, "Cell and Molecular Biology", Rastogi Publication, 2003
2. Molecular Biology of the Cell, Bruce Albert et al., Taylor and Francis, 2002

REFERENCE BOOKS:

1. Molecular Biology of the Cell, Baltimore, Damell J., Lodish, H. Baltimore, D., Freeman Publications, 2003
2. The Cell, T. Coopper, John Wiley and Sons, 2005
3. Cytology,Vermaand Aggarval, S. Chand Publications, 2003

.

BCS101	**FUNDAMENTALS OF COMPUTING AND PROGRAMMING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES

Students will understand the basics of computers and solve computer oriented problems using various computing tools.

COURSE OUTCOMES (COs)

CO1	Learn the fundamental principles in computing.
CO2	Learn to write simple programs using computer language
CO3	To enable the student to learn the major components of a computer system.
CO4	Computing problems

CO5	To learn to use office automation tools.
CO6	To interpret and relate programs

		Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low											
1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	L
2	CO1	H					H						
	CO2		L	H		M							
	CO3		L		S								
	CO4	M		M	W		M						
	CO5		L	L									
	CO6	H					H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO COMPUTER 9

Introduction- Characteristics of computer-Evolution of Computers-Computer Generations - Classification of Computers- Basic Computer Organization-Number system. Computer Software: Types of Software—System software-Application software-Software Development Steps

UNIT II PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program – Purpose – Algorithm – Flowcharts– Pseudo code Introduction to Office Packages: MS Word, Spread Sheet, Power Point, MS Access, Outlook.

UNIT III INTRODUCTION TO C 9

Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions. Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV ARRAYS AND STRUCTURES 9

Overview of C-Constants, Variables and Data types-Operators and Expressions -Managing Input and Output operators-Decision making-Branching and Looping.

UNIT V INTRODUCTION TO C++ 9

Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

TEXT BOOKS:

1. Ashok, N.Kamthane,"Computer Programming", Pearson Education (2012).
2. Anita Goel and Ajay Mittal,"Computer Fundamentals and Programming in C", Dorling V Kindersley (India Pvt Ltd).,Pearson Education in South Asia,(2011).
3. Yashavant P. Kanetkar, "Let us C",13th Edition,BPB Publications(2013).
4. Yashavant P. Kanetkar,"Let us C++"10th Edition, BPB Publications (2013**).**

REFERENCES:

1. Pradeep K.Sinha, Priti Sinha "Foundations of Computing", BPB Publications (2013).
2. Byron Gottfried, "Programming with C", 2nd edition, (Indian Adapted Edition), TMH Publication.
3. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in 'C' First Edition, Oxford University Press(2009).
4. The C++ Programming Language , 4th Edition, Bjarne Stroustrop, Addison-Wesley Publishing Company (2013).

BSS101	**PERSONALITY DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	1	1	0	2
	Prerequisite – +2 Level Knowledge				
	Course Designed by – Department of Management Studies				

OBJECTIVES

To make students groom their personality and prove themselves as good Samaritans of the society.

COURSE OUTCOMES (COs)

CO1	Individual or in-group class presentations pertaining to the applications of conce theories or issues in human development..
CO2	Scores obtained from essay and or objective tests.
CO3	Attendance, classroom participation, small group interactions.
CO4	Research and write about relevant topics.
CO5	Design and complete a research project that can take the form of a developmental intervi an observation or assessment through service learning.
CO6	Develop and maintain a Reflection

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	L
2	CO1	L		H				M					
	CO2		H	H				M					
	CO3							M	H				
	CO4									H	H		
	CO5							M			H	H	
	CO6							M					L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 9

The concept personality- Dimensions of theories of Freud & Erickson- personality – significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analyses.

UNIT II ATTITUDE & MOTIVATION 6

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages – Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT III SELF-ESTEEM 9

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV OTHER ASPECTS OF PERSONALITY DEVELOPMENT 9

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character-building -Team-work - Time management -Work ethics –Good manners and etiquette.

UNIT V EMPLOYABILITY QUOTIENT 9

Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

TEXT BOOKS:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition, Prentice Hall.

REFERENCE BOOKS:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002

3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

BCE 101	**BASIC CIVIL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Department of Civil Engineering				

OBJECTIVES: Understand the basic concepts of civil engineering.

COURSE OUTCOMES (COs)

CO1	Will gain knowledge in Design, concept preparation
CO2	Loading calculation
CO3	Structural component design
CO4	Drawing and chart preparation
CO5	Will understand the components of buildings.
CO6	Will learn the engineering aspects to dams , water supply and sewage disposal.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H	H			H		L					
	CO2					H	H						
	CO3							H	L				
	CO4									L			
	CO5										H	L	
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I CIVIL ENGINEERING MATERIALS 8

Introduction – Civil Engineering – Materials – Stones – Bricks – Sand – Cement – Plain Concrete – Reinforced Cement Concrete – Steel Sections – Timber – Plywood – Paints – Varnishes (simple examples only)

UNIT II SURVEYING 5

Surveying – objectives – classification – principles of survey-Measurement of distances – Chain survey – Determination of areas – Use of compass – Use of leveling Instrument – (simple examples only)

UNIT III FOUNDATION FOR BUILDING 5

Bearing Capacity of Soil – Foundation – Functions – Requirement of good foundations – Types of foundations – Merits & Demerits.

UNIT IV SUPERSTRUCTURE 7

Stone Masonry – Brick Masonry – Columns – Lintels – Beams – Roofing – Flooring – Plastering– White Washing (Simple examples only)

UNIT V MISCELLANEOUS TOPICS 5

Types of Bridges –Dam- purpose – selection of site - Types of Dams – Water Treatment & Supply sources – standards of drinking- distribution system. – Sewage Treatment (simple examples only)

TEXT BOOKS:

1. Raju.K.V.B, Ravichandran .P.T, "Basics of Civil Engineering", Ayyappa Publications, Chennai, 2012.
2. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, (1st ed. 2005).
3. Dr.M.S.Palanisamy, "Basic Civil Engineering" (3rded. 2000), TUG Publishers, New Delhi/Tata McGrawHill Publication Co., New Delhi

REFERENCE BOOKS:

1. Rangwala.S.C, "Engineering Materials", Charotar Publishing House, Anand, 41st Edition: 2014.
2. National Building Code of India, Part V, "Building Materials", 2005
3. Ramesh Babu"A Textbook on Basic Civil Engineering" (1998). Anuradha Agencies, Kumbakonam.
4. RamamruthamS., "Basic Civil Engineering", DhanpatRai Publishing Co. (P) Ltd. (1999).

BME101	BASIC MECHANICAL ENGINEERING	L	T	P	C
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

- The program educational objectives (PEOs) for the mechanical-engineering program are to educate graduates who will be ethical, productive, and contributing members of

society.

- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- The ability to apply principles of engineering, basic science, and mathematics to design and realize physical systems, components, or processes

COURSE OUTCOMES (COs)

CO1	an ability to apply knowledge of mathematics
CO2	an ability to apply knowledge of science, and engineering
CO3	Ability to design and conduct experiments, as well as to analyze and interpret data.
CO4	an ability to function on multi-disciplinary teams
CO5	ToprovidebasicKnowledgeofbasicmanufacturingprocess.
CO6	ability to identify, formulate, and solve engineering problems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ENERGY RESOURCESANDPOWER GENERATION 6

RenewableandNon-renewableresources-solar,wind,geothermal,steam,nuclearandhidepowerplants-Layout,
majorcomponentsandworking.ImportanceofEnergystorage,Environmentalconstraintsofpowergeneration usingfossil fuelsandnuclearenergy.

UNIT II IC ENGINES 6

Classification,workingprinciplesof petrol anddiesel engines-twostroke andfourstroke cycles,functionsofmain componentsofI.Cengine.Alternatefuelsandemissioncontrol.

UNIT III REFRIGERATION AND AIR-CONDITIONINGSYSTEM 6

Terminologyof Refrigerationand Air-Conditioning,PrincipleofVaporCompression& Absorptionsystem- Layoutoftypicaldomesticrefrigerator-window&Splittyperoomairconditioner.

UNITIV MANUFACTURING PROCESSES 6

BriefdescriptionofMouldmakesandcastingprocess,Metalforming,Classification typesofforging, forging operations, Briefdescription ofextrusion,rolling,sheetforging,anddrawing.Briefdescription ofwelding,brazing andsoldering.Principalmetalcuttingprocessesandcuttingtools,Brief descriptionofCentrelatheandradial drillingmachine.

UNITV MECHANICALDESIGN 6

Mechanicalpropertiesofmaterial-Yieldstrength,ultimatestrength,endurancelimitetc.,Stress-Strain curvesof materials.Stresses inducedinsimpleelements.Factorofsafety-Design ofShaftsandbelts. Typesofbearingsand itsapplications.Introductionto CAD/CAM/CIM&Mechatronics.

TEXTBOOKS:

1. T.J.Prabhuetal, "BasicMechanicalEngineering", SciTechPublications(p)Ltd,2000

REFERENCES:

1. NAGPAL,G.R,"PowerplantEngineering",KhannaPublishers,2004.
2. RAO.P.N,"ManufacturingTechnology",TataMcGraw-HillEducation,2000.
3. Kalpakjian,"ManufacturingEngineeringandTechnology",AdissoWesleypublishers,1995.
4. Ganesan.V,"Internalcombustionengines",TataMcGraw-HillEducation,2000.
5. C.P.Arora,"RefrigerationandAir Conditioning",TataMcGraw-HillEducation,2001.
6. V.B.Bhandari,"DesignofMachineelements",TataMcGraw-HillEducation,2010.

BCM1L1	**BASIC CIVIL & MECHANICALENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – Basic Civil and Mechanical Engineering				
	Course Designed by – Department of Mechanical Engineering& Civil Engineering				

OBJECTIVES

To provide exposure to the students with hands on experience on various basic Civil & Mechanical Engineering practices.

COURSE OUTCOMES (COs)

CO1	Learn Basic concepts
CO2	Students will get exposure regarding pipe connection for pumps & turbines and to study the joint used in roofs, doors, windows and furniture's.
CO3	Students will get exposure regarding smithy, foundry operations and in latest welding operations such as TIG, MIG, CO2, spot welding etc.,
CO4	Students will get hands on experience on basic welding techniques, machining and sheet metal works.
CO5	Students will get hands on experience on basic machining techniques
CO6	Students will get hands on experience on basic sheet metal techniques

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H	L										
	CO2				H								
	CO3					H	L	L					
	CO4		H				M		L			H	
	CO5		H				M		L			H	
	CO6		H				M		L			H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

LIST OF EXPERIMENTS

I. CIVILENGINEERINGPRACTICE

Buildings:

a) Studyofplumbingandcarpentrycomponentsofresidentialandindustrialbuildings.Safetyaspects.

PlumbingWorks:

a) Studyofpipelinejoints,itslocationandfunctions:valves,taps,couplings,unions,reducers,elbowsin householdfittings.

b) Studyofpipeconnectionsrequirementsforpumpsandturbines.

c) Preparationofplumbinglinesketchesforwatersupplyandsewageworks.

d) Hands-on-exercise:Basicpipeconnection ofPVCpipes&G.I.Pipes–Mixedpipematerialconnection–Pipe connectionswithdifferentjoiningcomponents.

e) Demonstrationofplumbingrequirementsofhigh-risebuildings.

CarpentryusingHandtoolsandPowertools:

a) Studyofthejointsinroofs,doors,windowsandfurniture.

b) Hands-on-exercise:Woodwork,jointsbysawing,planningandcutting.

c) Preparationofhalfjoints,MortiseandTenonjoints.

II MECHANICALENGINEERINGPRACTICE

Welding:

a) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

BasicMachining:

a) Simple Turning and Taper turning

b) Drilling Practice

SheetMetalWork:

a) Forming&Bending:

b) Modelmaking–Trays,funnels, etc.

c) Differenttypeofjoints
d) Preparationofair-conditioningducts
e) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

Machineassemblypractice:

a) Assembling,dismantlingand Studyofcentrifugalpump
b) Assembling,dismantlingand Studyofairconditioner
c) Assembling,dismantlingandStudyoflathe

Moulding:

a) Mouldingoperationslikemouldpreparationfor gearandstepconepulleyetc

Fitting:

a) Fitting Exercises–Preparationofsquarefittingandvee–fittingmodels.

Demonstration:

a) Smithyoperations,upsetting,swaging,settingdownandbending.Example–Exercise–Productionofhexagonalheaded bolt.
b) Gaswelding.

REFERENCES:

1. K. Jeyachandran, S. Nararajan& S, Balasubramanian, "A Primer on Engineering Practices Laboratory" ,Anuradha Publications, (2007).
2. T.Jeyapoovan, M. Saravanapandian& S. Pranitha, "Engineering Practices Lab Manual",Vikas Publishing House Pvt. Ltd. (2006)
3. H. S. Bawa, "Workshop Practice", Tata McGraw–Hill Publishing Company Limited, (2007).
4. A. Rajendra Prasad & P. M. M. S Sarma, "Workshop Practice", SreeSai Publication, (2002).
5. P. Kannaiah& K.L. Narayana, "Manual on Workshop Practice", Scitech Publication, (1999).

	PHYSICS AND CHEMISTRY LABORATORY	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
BPC 1L1/2L1	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				

OBJECTIVES: To impart knowledge to the students in practical physics and chemistry

COURSE OUTCOMES (COs)

CO1	Students will understand the concept of hall effect
CO2	Students will understand the concept of semiconductors. .
CO3	Student will understand the working of spectrometer.
CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M

	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective	Non-Major Elective (NE)		Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
				√									
4	Approval	37th Meeting of Academic Council, May 2015											

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS 1L5 /2L5 NSS PRACTICAL L T P C

0 1 2 1

OBJECTIVES

1. Understand the community in which they work and their relation
2. Identify the needs and problems of the community and involve them in problem-solving

3. Develop capacity to meet emergencies and natural disasters
4. Practice national integration and social harmony and
5. Utilize their knowledge in finding practical solutions to individual and community problems.

1. Regular Activities Programme

1) Traffic regulation
2) Working with Police Commissioner's Office
3) Working with Corporation of Chennai
4) Working with Health Department
5) Blind assistance
6) Garments collection
7) Non-formal education
8)Environmental Education, Awareness and Training (EEAT)
9) Blood donation

2.Special camp Programme

A) Legal awareness
B) Health awareness
C) First-aid
D) Career guidance
E) Leadership training - cum - Cultural Programme
F) Globalization and its Economic Social Political and Cultural impacts.

REFERENCE BOOKS:

1. National Service Scheme Manual, Government of India.
2. Training Programme on National Programme scheme, TISS.
3. Orientation Courses for N.S.S. Programme officers, TISS.
4. Case material as Training Aid for field workers, Gurmeet Hans.
5. Social service opportunities in Hospitals, Kapil K.Krishan,TISS.
6. Social Problems in India, Ram Ahuja.

BEN 201	**ENGLISH II**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – English I				
	Course Designed by – Department of English				

OBJECTIVES	
Students will be able to actively participate in group discussions. Students will have Telephonic Skills, Giving Directions and Information Transfer	
COURSE OUTCOMES (COs)	
CO1	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)
CO2	To make students comprehend the habit of intelligent Reading as well as Computer-based competitive exams glob
CO3	To achieve a reasonably good level of competency in Report Writing.
CO4	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)

CO5	To achieve a reasonably good level of competency in group discussions												
CO6	To achieve a reasonably good level of competency in public speaking												
	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	M	L	H	L	M			H		M	L	
	CO2			H	L				H		M	L	
	CO3			H	L	M			H		H	L	
	CO4			H	L	M			H		M	L	
	CO5			H	L	M			H		M	L	
	CO6			H	L	M			H		M	L	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Professional Elective (PE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship	
		√											
4	Approval			37th Meeting of Academic Council, May 2015									

UNIT I ORIENTATION 12

Numerical adjectives - Meanings in context - Same words used as different parts of speech -Paragraph writing - Non- verbal communication - Regular and Irregular verbs.

UNIT II ORAL SKILL 12

Listening to audio cassettes - C.Ds , News bulletin - Special Lectures, Discourse - Note taking - Sentence patterns - SV, SVO, SVC, SVOC, SVOCA - and Giving Instructions - Reading Comprehension answering questions. Inferring meaning.

UNIT III THINKING SKILL 12

Self- introduction describing –Group Discussion – Debate –Role play- Telephone- Things- etiquette- Recommendation and Sequencing jumbled sentences to make a suggestions-paragraph-advertisement and notice, Designing or drafting posters, writing formal and informal invitations and replies.

UNIT IV WRITING SKILL 12

Definitions - Compound nouns - Abbreviations and acronyms – (a) business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) Letters to the editor (giving suggestions on an issue) .

UNIT V FORMAL INFORMATION 12

Editing – Prepositions - Articles - Permission letter for undergoing practical training , Essay writing - Application for a job , letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

TEXT BOOK:

1. Meenakshi Raman, Sangeetha Sharma , Technical English for Communication: Principle and Practice, OUP, 2009.

REFERENCE BOOKS:

1. Sumanth , English for Engineers, Vijay Nicole , Imprints pvt ltd.2013.
2. Meenakshi Raman and Sangeetha Sharma , Technical Communication Principles and Practice, Oxford University Press, 2009.
3. Sangeetha Sharma, Binodmishra , Communication skills for engineers and scientists , PHI Learning Pvt Ltd, New Delhi, 2010.

BMA 201	**MATHEMATICS – II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – Mathematics I				
	Course Designed by – Department of Mathematics				

OBJECTIVES

Ability to apply these principles of mathematics in projects and research works.

COURSE OUTCOMES (COs)

CO1	Student shall be able to Solve differential equations, simultaneous linear equations, and sc special types of linear equations related to engineering.
CO2	Relate the use of mathematics in applications of various fields namely fluid flow, heat fl solid mechanics, electrostatics, etc.
CO3	Ability to test hypothesis
CO4	Find intensity of degree of relationship between two variables and also bring out regress equations.
CO5	Understand to solve matrix problems related to real life problems.
CO6	Formulate mathematical models

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H		L									
	CO2		H				H		L	L		M	
	CO3		H				H		L	L		M	
	CO4					M						M	
	CO5										M	M	
	CO6										M		

3	Category	Humanities & Social	Basic Sciences	Engg Sciences	Professional Core	Professional Electi	Non-Major Electi	Open Electi ve	Project/Term Pa
			√						

4	Approval		37th Meeting of Academic Council, May 2015

UNIT I ORDINARY DIFFERENTIAL EQUATION 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters **– Cauchy's** and L**egendre's linear equations** - simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient, divergence and curl –Directional derivatives –Irrotational and solenoidal vector fields – vector integration**– Green's theorem in a plane , Gauss divergence theorem and** S**toke's theorem (**without proofs) **–** simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable **–** Analytic functions **–** Necessary conditions, Cauchy-Riemann equation and sufficient conditions (without proofs) **–** Harmonic and orthogonal properties of analytic functions **–** Harmonic conjugate **–** construction of analytic functions **–** conformal mapping: W= Z+C, CZ, 1/Z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration **– Statement and application of Cauchy's integral theorem and Cauchy's integral formula –**Taylor and Laurent expansions **–** Singular points **–** Residues **–** Residue theorem **–** Application of Residue theorem to evaluate real integrals **–** Unit circle and semi-circular contour (excluding poles on boundaries).

UNIT V STATISTICS 12

Mean, Median, Mode **–** Moments **–**Skewness and Kurtosis **–** Correlation **–** Rank Correlation **–** Regression **–**Chi square test for contingency tables.

TEXT BOOK:

1. R.M.Kannan and B.Vijayakumar" Engineering Mathematics–II "2nd Edition, SRB Publication, Chennai 2007.
2. Bali.N.P and Manish Goyal , "Engineering Mathematics", 3rd Edition, Laxmi Publications (P) Lltd, 2008 .
3. Grewal .B/S "Higher Engineering Mathematics", 40th Editon, Khanna Publications, Delhi, 2007

REFERENCES :

1. Ramana.B.V, "Higher Engineering Mathematic", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Gupta SC, and VK.Kapoor, "Fundamentals Mathematical Statistics", 11th edition, Sultan Chand Sons, New Delhi, 2014.

BPH201	**ENGINEERING PHYSICS -II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING PHYSICS -I				

	Course Designed by – Department of Physics

OBJECTIVES

- To expose the students to multiple areas of science of engineering materials which have direct relevance to different Engineering applications
- To understand the concepts and applications of conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties.

COURSE OUTCOMES (COs)

CO1	Understand about properties and advancements of conducting materials.
CO2	Understand the principle and properties semiconducting materials.
CO3	Acquire Knowledge on Magnetic and dielectric Materials.
CO4	To Know about the creation of new materials with novel properties
CO5	To Understand the impact of modern materials in technical uses.
CO6	Learn new engineering materials and its characteristics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L								
	CO5		L	L									
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type

semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications.

TEXT BOOKS:

1. Jayaraman D Engineering Physics II. Global Publishing House, 2014.
2. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
3. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

REFERENCES:

1. Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4 http://ocw.mit.edu/courses/find-by-topic
5 http://nptel.ac.in/course.php?disciplineId=122
6 https://en.wikipedia.org/wiki/Engineering_physics

BCH 201	**ENGINEERING CHEMISTRY-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING CHEMISTRY –I				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Students will understand the concepts and further industrial applications of surface chemistry
CO2	To impart knowledge about the Industrial importance of Phase rule and alloys

CO3	To make the students to be conversant with Analytical techniques of chemistry and their importance
CO4	To have an idea and knowledge about the Chemistry of Fuels and
CO5	Understanding of engineering materials
CO6	All about bonding and molecular structures

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L		H		H				M	
	CO2		H			H		H					
	CO3	H		L		H		H				M	
	CO4			L		H		H					
	CO5			L		H		H					
	CO6			L		H		H		H		M	

3	Category	Humanities & Social	Basic Sciences	Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective	Open Elective (OE)	Project /Term Paper/ Semin
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I SURFACE CHEMISTRY 9

Introduction **:** Adsorption , absorption , desorption , adsorbent , adsorbate and sorption – (definition only) Differences between adsorption and absorption Adsorption of gases on solids – factors affecting adsorption of gases on solids – Adsorption isotherms –Frendlich adsorption isotherm and Langmuir adsorption isotherm Role of adsorbents in catalysis, Ion-exchange adsorption and pollution abatement.

UNIT II PHASE RULE AND ALLOYS 9

Introduction **:**Statement of Phase Rule and explanation of terms involved – one component system – water system – Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only] Two Component System : Simple eutectic systems (lead-silver system only) – eutectic temperature – eutectic composition – Pattinsons Process of desilverisation of Lead Alloys: Importance, ferrous alloys –nichrome and stainless steel – 18/8 stainless steel -heat treatment of steel – annealing – hardening – tempering normalizing – carburizing - nit riding . Non- ferrous alloys: Brass and Bronze

UNIT III ANALYTICAL TECHNIQUES 9

Introduction: Type of Spectroscopy - Atomic spectroscopy – molecular spectroscopy - Explanation IR spectroscopy – principles – instrumentation (block diagram only) – applications - finger print region UV-visible spectroscopy –– principle – instrumentation (block diagram only) – Beer-**Lambert's law**- – estimation of iron by colorimetry– Atomic absorption spectroscopy- principle - instrumentation (block diagram only) - estimation of Nickel by Atomic absorption spectroscopy Flame photometry– principles – instrumentation (block diagram only) - estimation of sodium ion by Flame photometry

UNIT IV FUELS **9**

Introduction **:** Calorific value – types of Calorific value - gross calorific value – net calorific value Analysis of Coal –- Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto-Hoffmann method Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only) Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG (definition and composition only) Flue gas analysis – importance - Orsat apparatus

UNIT V ENGINEERING MATERIALS **9**

Introduction: Refractory's – classification – acidic, basic and neutral refractory's – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Manufacture of Refractory's: alumina bricks and Magnesite bricks, Abrasives – natural and synthetic abrasives Natural type : Siliceous - quartz ; Non –siliceous – diamond Synthetic Abrasives : silicon carbide and boron carbide. Lubricants: Liquid lubricants - Properties – viscosity index, flash and fire points, cloud and pour points, oiliness) Solid lubricants – graphite and molybdenum sulphide

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

REFERENCES:

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub. Co.Ltd, New Delhi,(2008)
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Spectroscopy

BCS 202	INTERNET PROGRAMMING	L	T	P	C
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Fundamentals of Computer				
	Course Designed by – Dept of Information Technology				

OBJECTIVES

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science.

COURSE OUTCOMES (COs)

CO1	To enable the student to learn the major components of a computer system.
CO2	To know the correct way of solving problem.
CO3	To identify efficient way of solving problem.
CO4	To learn to use office automation tools.

CO5	To implement office automation tools
CO6	To learn and write program in "C".

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities	Basic Sc	Engg Sc	Profession	Core Elect	Non-Tech	Open	Project Work
				√					
4	Approval	37th Meeting of Academic Council, May 2015								

UNIT I BASIC INTERNETCONCEPTS 6

Internet principles-IPaddressing-Internet Service Provider (ISP)-URL-Basic web concepts-World WideWeb (WWW)-Intranet and Extranet-Internet Protocols: HTTP, TCP, UDP, FTP, Telnet-Domain Name System(DNS)-E mail-Next generation internet.

UNIT II WEBDESIGNBASICS 6

Introduction to HTML–Structureof HTMLDocument– Tags-Headings–Links–Images–Lists–Tables –Forms–Frames-Style sheets andits types.

UNITIII DYNAMIC HTML 6

Introduction to DynamicHTML-Object modeland collections-Event model-Filters and transition-Data binding-Data control-Activexcontrol.

UNIT IV CLIENT ANDSERVERSIDEPROGRAMMING 6

VBScript&JavaScript:Introduction-Operators–Data type-Control structures-Looping–Classes andObjects–Arrays-Functions-Events-Exampleprograms.

UNITV INTERNETAPPLICATIONS 6

Onlinedatabase-functionsofonlinedatabase-MeritsandDemerits-InternetInformationSystems (IIS)-EDIapplications inbusiness and its types-Internet commerce-Types and Applications

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TEXT BOOKS:

1. Deitel, Deitel and Nieto, ''Internet and World Wide Web- How to program'', Pearson Education Publishers, 5th edition, 2008.
2. Elliotte Rusty Harold, ''Java Network Programming'', O'Reilly Publishers, 2010
3. Java Script: A Beginners Guide John Pollock 4thEdition, TMH Edition (2013)
4. VB Script Beginners Guide, Jyoti B. Giramkar, Create Space Independent Publishing (2014)

REFERENCES:

1... Krishnamoorthy & S.Prabhu, ''Internet and Java Programming'', New Age International Publishers, 2010.

2. Thomno A.Powell, ''The Complete Reference HTML and XHTML'', fourth edition, Tata McGraw Hill, 2001

3. E Commerce Kamlesh K.Bajaj, Debjani Nag, Tata McGraw Hill, Second edition, 2010

BFR 201	FRENCH	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

Language gives access and insights into another culture. It is a fundamental truth that cultures define themselves through languages.

COURSE OUTCOMES (COs)

CO1	Introduce the basics of the language to beginners
CO2	Understand a dialogue and dialogue presentation
CO3	To develop their knowledge as well as their communicative skills so as to be able to respond in simple everyday contexts.
CO4	Synchronies I includes documents which initiate the learners to another world, another culture and which acclimatize them to the authentic use of the French language through the exploitation of written and iconographic documents. The Indian context has been used.
CO5	Grammatical and lexical notions as well as activities required for communication are learnt by the students.
CO6	Interpreting skills and confidence in the language.
CO6	Interpreting skills and confidence in the language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humaniti	Basic Sc	Engg Sc	Prof es	Core El	Non - M	Ope	Proj ect /T er
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION 8

At the airport: Savoir– faire: exchanging greetings, self introduction, introducing another, welcoming someone, identifying someone - Grammar: verbs 'to be', 'to call oneself', subject pronouns, interrogation

UNIT II GRAMMAR 8

At the University: Savoir-faire: enquiring after one's welfare, taking leave, expressing appreciation - Grammar: definite & indefinite articles, gender of nouns, adjectives, present tense of regular 'er' verbs, 'to have', 'to learn', negation, irregular verbs

UNIT III CONVERSATION 8

At the café: Savoir –faire: speaking about one's likes, giving information, expressing admiration, asking information about someone - Grammar: Interrogative adjectives, irregular verbs, possessive and interrogative adjectives

UNIT IV PROPOSAL WRITING 7

At the beach: Savoir faire: proposing an outing, accepting/ refusing the proposal - Grammar: singular & plural, indefinite pronoun, demonstrative adjectives, negation, irregular verbs

UNIT V FORMAL LETTERS 7

A concert: Savoir –faire: inviting, accepting, expressing one's inability to accept an invitation

UNIT VI REGULAR & IRREGULAR VERBS 7

Grammar: Present tense of more irregular verbs, contracted articles, future tense, interrogative adverbs, **At Nalli's** Savoir- faire: asking the price of an article, protesting against the price, Grammar: possessive adjectives, Exclamative adjectives, imperative tense

REFERENCES:

1. Course Material: Synchronie I –Méthode de Français
2. Madanagobalane -Samita Publications, Chennai, 2007

BGM 20	**GERMAN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

At the end of this course, students shall be able to obtain good knowledge of the language, to r write and speak German, whereby the emphasis is laid on speech.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.

CO3	Will develop basic conversational skills.
CO4	Will understand German lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

Course structure:

A. German Language (speaking, reading, writing, grammar and test)
B. Life in Germany (shopping, restaurant, doctor, government, bank, post)
C. The German Way (introduction, doing business, conversation, meetings, dining)
D. Germany (Culture, Climate)

UNIT I PRONOUNCIATION 9

Welcome: Introduction to the Language, Spelling and Pronunciation (The alphabets and numbers) Greetings, ordering, requesting, saying thank you - Grammar **– the article "the", conjugation** of verbs

UNIT II SELF INTRODUCTION 9

Shopping - Grammar **–** adjectives, endings before nouns, practice. Self introduction

UNIT III TRAINING 9

Addresses, Occupations, Studies - Grammar **- 'to be', the definite/indefinite** articles, individual Training

UNIT IV ORAL 9

Leisure Time, Sports, Hobbies - Grammar **–** position of a verb in a main clause , oral practice

9

UNIT V NARRATION

At a Restaurant, Food and Drink - Grammar – the personal pronoun in the Nominative and Accusative, Narrating an event

RESOURCES:

1. Sprachkurs Deutsch 1 (Verlag Diesterweg), New Delhi Learning Centre

BJP 201	**JAPANESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Japanese language, Japanese culture and heritage
To impart knowledge Japanese lifestyle.
To give sufficient exposure to develop basic conversational skills.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Japanese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I CULTURAL HERITAGE 9

Introduction-history and origin of Japanese language-Japan and its cultural heritage-Self introduction-counting numbers (1-100)-time-conversation with the use of audio devices, grammar– usage of particles wa, no, mo and ka

UNIT II USAGE 9

Greetings, seasons, days of the week and months of the year-numbers (up to 99,999)-grammar– usage of kore, sore, are, kono, sono, ano, koko and kochira, arimasu and imasu-i-ending and na-ending adjectives-use of audio and drills for practice

UNIT III ORAL 9

Asking the price–associated vocabulary-usage of particles ni, ga and ne- use of audio and drills for practice-Introduction to basic Kanji characters- use of audio and drills for practice

UNIT IV ART AND CULTURE 9

Family relationships- colours-Kanji (numbers) and festivals of Japan-religion-Japanese art and culture-ikebana, origami-introduction to hiragana- use of audio and drills for practice

UNIT V DRILLS AND PRACTICE 9

Vocobulary associated with directions-asking way-particles – e, de, mo, koko, soko, asoko, doko, nani, mae, ushiro, ue, shita- use of audio and drills for practice-introduction to katakana

TEXT BOOKS

1. Japanese Hiragana and Katakana for beginners, Timothy G. Stout, 2011
2. Genki I: An integrated course in elementary Japanese, Eri Banno and Yuko Ikeda, 2011

REFERENCE BOOKS

1. Japanese Reader collection Volume I, Yumi Boutwell and Clay Boutwell, Kotoba books, 2013
2. Living Language Japanese Complete Edition beginners through advanced course, Living Language, 2012

BKR 201	**KOREAN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Korean language, Korean culture and heritage
To impart knowledge on Korean lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.

CO4	Will understand Korean lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I PLANNING 9

Asking/giving reasons for studying Korean, making plans for the holiday, writing letters, describing past travel experiences and future travel plans, shopping in a grocery store, shopping in electronics store, storytelling Grammar: would like to (do), want to (do), construct future tense.

UNIT II MODIFIERS 9

Asking about feelings, asking about problems and giving advice, brief introductions - Grammar: Noun modifier, please try doing (something), irregular adjective/verb

UNIT III PLACING ORDERS 9

Asking about hobbies, asking about abilities (sports), job requirements, Ordering things for delivery, ordering a meal at a restaurant - Grammar: Sentence ending for the honorific form, please do something for me, have tried (something),

UNIT IV DESCRIPTIONS 9

Asking about evening plans, making plans with others, making preparations - Asking about rooms, describing your room to your classmates, describing your house. Grammar: to know/not know how to do something, must (do), have to (do), should,

UNIT V GRAMMAR 9

Describing your plans and giving reasons, cancelling appointments. Grammar: Shall we~? / Should we~?, with, and, irregular verbs/adjective, so, because, cannot, intend to, plan to, or hope to, (more) than, the most, tag question/is n't it? ,will (do)

COURSE MATERIAL:

Korean for Non-Native Speakers (Student Book 1B) Korean Language Education Center, Sogang University

BCN 201	**CHINESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Chinese language, Chinese culture and heritage

To impart knowledge on Chinese lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Chinese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT 1 RISE OF DIALECTS 9

History, Origins, Old and middle Chinese, Rise of northern dialects

UNIT II VARIETIES 9

Influences 3 Varieties of Chinese. 1.Classification 2.Standard Chinese and 3.Nomenclature

UNIT III CHARACTERS 9

Chinese characters, Homophones, Phonology

UNIT IV TRANSCRIPTIONS **9**

Tones, Phonetic transcriptions, Romanization, Other phonetic transcriptions

UNIT V GRAMMAR **9**

Grammar and morphology, Vocabulary, Loanwords, Modern borrowings and loanwords

REFERENCES:

1. Hannas, William C. (1997), Asia's Orthographic Dilemma, University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-1892-0" 978-0-8248- 1892-0.
2. Qiu, Xigui (2000), Chinese Writing, trans. Gilbert Louis Mattos and Jerry Norman, Society for the Study of Early China and Institute of East Asian Studies, University of California, Berkeley, ISBN HYPERLINK http://en.wikipedia.org/wiki/Special:BookSources/978-1-55729-071-7,978-1-55729-071-7.
3. Ramsey, S. Robert (1987), The Languages of China, Princeton University Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-691-01468-5" 978-0-691-01468-5.
4. Schuessler, Axel (2007), ABC Etymological Dictionary of Old Chinese, Honolulu: University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-2975-9"978-0-8248-2975-9.
5. R. L. G. " Language borrowing Why so little Chinese in English?" The Economist. June 6, 2013.

BBT 201	**PRINCIPLES OF GENETICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – Basic biology, concepts in genetics				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a fundamental knowledge on genetics, its laws, genes and chromosomes, inherita heredity, causes of genetic disorders and the methods of gene transfer

COURSE OUTCOMES (COs)

CO1	To understand the fundamentals of genetics and the Mendelian laws
CO2	To understand about the structure and organization of chromosomes in prokary eukaryotes
CO3	To understand about the structure and organization of chromosomes in eukaryotes
CO4	To understand the concept of alleles in blood grouping and sex determination
CO5	To know the concept of linkage and crossing over of genes
CO6	To get a basic knowledge of the methods of gene transfer

UNIT I BASICS OF GENETICS **6**

Classical genetics, Mendelian Laws- Mendel's experiment-monohybrid cross-phenotype, genotype, Dihybrid inheritance, Interaction of genes, Fine structure of Genes

UNIT II CHROMOSOMES 6

Chromosome structure and organization in prokaryotes and eukaryotes, unusual chromosomes- chromosome banding, chromosome abnormalities- genetic disorders

UNIT III ALLELES 6

Classical concepts of Pleomorphism, Multiple alleles, ABO blood groups, Rh factor, sex linkage in Drosophila, linkage in human beings, mechanism of sex determination, XX-XY mechanisms of sex determination, sex determination in Drosophila, environmental factors and sex determination, sex differentiation.

UNIT IV CROSSING OVER 6

Coupling and Repulsion-Hypothesis, Test cross in maize and crossing over, theory of crossing over, molecular mechanism of crossing over, sex chromosomes and sex linked inherited disorders, colour blindness, hemophilia, Muscular dystrophy.

UNIT V GENE TRANSFER 6

Transformation, Tansduction, Conjugation, Plasmids and Episomes

TEXT BOOKS:

1. Principles of Genetics, Gardner, Simmons and Snustad, John Wiley and Sons (Asia), 2002
2. Genes VIII, Lewin, International Edition, Prentice Hall, 2004

REFERENCE BOOKS:

1. Instant Notes in Genetics, P.C. Winter, G.I. Hickey and H.L. Fletcher, Viva Books Private Limited, 2003
2. Weblink: nptel

BEE 201	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Engineering Mathematics, Engineering Physics-I & II				
	Course Designed by – Department of Electrical & Electronics Engineering				
OBJECTIVES: To understand the laws of electrical engineering.					
COURSE OUTCOMES (COs)					
CO1	Students will gain knowledge regarding the various laws and principles associated with electrical systems.				
CO2	Students will gain knowledge regarding electrical machines and apply them for practical problems.				
CO3	Students will gain knowledge regarding various types semiconductors.				
CO4	Student will gain knowledge digital electronics.				
CO5	Student will gain knowledge on electronic systems.				
CO6	Students will acquire knowledge in using the concepts in the field of electrical engg. projects and research.				

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L			
	CO2		H	M			L		L	L			
	CO3		H	M			L		L				
	CO4	M	H	M			L		L	L			
	CO5	M	H	M			L		L				
	CO6		H				L		L	H			
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective	Non-Major Elective (NE)		Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I ELECTRIC CIRCUITS 6

Ohm's law – Kirchoff's Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem –Thevenin's and Norton's Theorem -Problems.

UNIT II ELECTRICAL MACHINES 6

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors**.** -Single phase Induction Motor - Single Phase Transformer.

UNIT III BASIC MEASUREMENT SYSTEMS 6

Introduction to Measurement Systems, Construction and Operating principles of PMMC, Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meter and two watt method – and Energy meter.

UNIT IV SEMICONDUCTOR DEVICES 6

Basic Concepts of semiconductor devices – PN Junction Diode Characteristics and its Applications – HWR, FWR –Zener Diode – BJT (CB, CE, CC) configuration & Characteristics.

UNIT V DIGITAL ELECTRONICS 6

Number system – Logic Gates – Boolean Algebra– De-**Morgan's Theorem –** Half Adder & Full Adder – Flip Flops.

TEXT BOOKS:

1. N.Mittal "Basic Electrical Engineering". Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.

3. Jacob Millman and Christos C-Halkias, “Electronic Devices and Circuits”, Tata McGraw Hill

REFERENCE BOOKS:

1. Edminister J.A. “Theory and Problems of Electric Circuits” Schaum’s Outline Series. McGrawHill Book Compay, 2nd Edition, 1983.
2. Hyatt W.H and Kemmerlay J.E. “Engineering Circuit Analysis”, McGraw Hill Internatinal Editions, 1993.
3. D. P. Kothari and I. J. Nagrath“ Electric Machines”Tata McGraw-Hill Education, 2004
4. Millman and Halkias, “Integrated Electronics”, Tata McGraw Hill Edition, 2004.

BCS2L1	INTERNET PRACTICES LABORATORY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Internet Programming				
	Course Designed by – Dept of Information Technology				

OBJECTIVES

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer sc

COURSE OUTCOMES (COs)

CO1	To enable the student to learn the major components of a computer system.
CO2	To know the correct and efficient way of solving problem.
CO3	To identify and implement the correct and efficient way of solving problem.
CO4	To learn to use office automation tools.
CO5	To infer from use office automation tools.
CO6	To learn and write program in “C”.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective	Non-Major Elective	Open Elective	Project/Term Paper/ Seminar/ Internship (PR)

				√					
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. **HTML (Hypertext Mark-up Language):**
   Basics of HTML.
   How to create HTML Document
   Steps for creating a simple HTML Program.
   a) Favorite Personality
   b) Resume Preparation
2. **ADVANCED HTML:** Advanced Topics of HTML
   a) Time Table
   b) Table Creation
3. **JAVASCRIPT:**
   Script Basics.
   Incorporating JavaScript into Web page.
   a) Star Triangle
   b) Temperature Converters
   Script Basics.
   Incorporating JavaScript into Web page.
   a) Star Triangle
   b) Temperature Converters
4. **VBSCRIPT:**

VBScript Basics.
Incorporating VBScript into HTML.
a) Changing Background Color
b) Simple Calculator

5. **WEB DESIGN:**

Inserting External Media in the Web Page.
a) Forms and Links
b) Frames with Links and Lists
To export a Dream weaver Document as XML File, checking entries, working in frames, windows control, the java script URL.

BCS 2L2	**COMPUTER PRACTICE LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	1
	Prerequisite – Fundamentals of Computer				
	Course Designed by – Department of Computer Science &Engineering				
OBJECTIVES: To impart basic computer knowledge					
COURSE OUTCOMES (COs)					
CO1	Demonstrate major algorithms and data				
CO2	Implementation of array operations				

CO3	Implementation of binary tree.
CO4	Implementation of linked list
CO5	Students will able to do analyse data using spread sheet
CO6	Student will able to understand the basics of C programming.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H	H	L	H		H		L		H	H	H
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

A) WORD PROCESSING **6**

Document creation, Text manipulation with Scientific Notations. Table creation Table formatting and Conversion. Mail merge and Letter Preparation. Drawing-Flow Chart

B) SPREAD SHEET **9**

Chart-Line Xy Bar and Pie – Formula-Formula Editor-Spread sheet-Inclusion of Object, Picture and Graphics Protecting the document and sheet-Sorting and Import/Export features.

C) SIMPLE C PROGRAMMING* **15**

Data types, Expression Evaluation, Condition Statement. Arrays structures and Unions – Functions

D) SIMPLE C++PROGRAMMING **15**

-Classes and Objects

-Constructor and Destructor

***For Programming exercises Flow chart and Pseudo code are essential.**

	BASIC ELECTRICAL AND ELECTRONIC ENGINEERING PRACTICES LABORATORY	**L**	**T**	**P**	**C**
BEE2L1	Total Contact Hours – 45	0	0	3	1

	Prerequisite – Basic Electrical and Electronics Engineering
	Course Designed by – Department of Electrical & Electronics Engineering

OBJECTIVES: To enhance the student with knowledge on electrical and electronic equipments.

COURSE OUTCOMES (COs)

CO1	Students will able to handle basic electrical equipments.
CO2	Students will able to do staircase wiring.
CO3	Students will able to understand domestic wiring procedures practically.
CO4	Student will able to assemble electronic systems.
CO5	Students will understand all the fundamental concepts involving electrical engineering
CO6	Students will understand all the fundamental concepts involving electronics engineering

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	
	CO5	M	H	M			L		L		M	H	
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

I LIST OF EXPERIMENTS FOR ELECTRICAL ENGINEERING LAB

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

II LIST OF EXPERIMENTS FOR ELECTRONICS ENGINEERING LAB

1. Study of electronic components and equipments.
   a. Resistor colour coding using digital multi-meter.
   b. Assembling electronic components on bread board.

2. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
3. Soldering and desoldering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

BPC 1L1/2L1	**PHYSICS AND CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				

OBJECTIVES: To impart knowledge to the students in practical physics and chemistry

COURSE OUTCOMES (COs)

CO1	Students will understand the concept of hall effect
CO2	Students will understand the concept of semiconductors. .
CO3	Student will understand the working of spectrometer.
CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

I -LIST OF EXPERIMENTS – PHYSICS

14. Determination of Wavelength, and particle size using Laser
15. Determination of acceptance angle in an optical fiber.
16. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
17. Determination of wavelength of mercury spectrum – spectrometer grating

18. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
19. Determination of Young‟s modulus by Non uniform bending method
20. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
21. Determination of Young‟s modulus by uniform bending method
22. Determination of band gap of a semiconductor
23. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
24. Determination of Dispersive power of a prism - Spectrometer
25. Determination of thickness of a thin wire – Air wedge method
26. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS1L7/BSS2L7 YOGA FOREMPOWERMENT

L	T	P	C
0	1	2	1

OBJECTIVE:

Providing Value Education to improve the Students' character - understanding yogic life and physical health - maintaining youthfulness - Measure and method in five aspects of life

UNIT I PHYSICAL HEALTH 6

Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment.

Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits.

Yogasanas 1: Pranamasana - Hastha Uttanasana - Pada Hasthasana - Aswa Sanjalana Asana - Thuvipatha asva Sanjalana asana - Astanga Namaskara - Bhujangasana - Atha Muktha Savasana - Aswa Sanjalana Asana - Pada Hasthasana - Hastha Uttanasana - Pranamasana.

Pranayama: Naddi suddi - Clearance Practice - Benefits.

Simplified Physical Exercise - Kayakalpa Practices - Meditation Practices.

UNIT II LIFE FORCE 6

Reasons for Diseases: Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds)

Philosophy of Kaya kalpa: Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind.

Maintaining youthfulness: Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid - Measure and method in five aspects of life - Controlling undue Passion.

Kayakalpa practice: Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

UNIT III MENTAL HEALTH 6

Mental Frequencies: Beta, Apha, Theta and Delta wave-Agna Meditation explanation-benefits.

Shanti meditation: Shanthi Meditation explanation-benefits

Thuriya Meditation: Thuriya Meditation explanation-benefits

Benefits of Blessing: Self blessing(Auto suggestion) - Familyblessing-Blessing the others-World blessing-Divineprotection

UNIT IV VALUES 6

Human Values: Self control-Self confidence - Honesty Contentment - Humility-

Modesty Tolerance – Adjustment - Sacrifice-Forgiveness
Purity(Body,Dress,Environment)-Physicalpurity-Mentalpurity - Spiritual purity

Social Values :
Non violence-Service Patriotism-Equality
Respectforparentsandelders-careandprotection-Respectforteacher Punctuality-TimeManagement

UNIT V MORALITY (virtues) 6
Importance of Introspection: I-Mine (Ego, Possessiveness)
SixEvilTemperaments-Greed-Anger-Miserliness-Immoralsexualpassion-InferiorityandsuperiorityComplex-Vengeance
Maneuvering of Six Temperaments:Contentment-Tolerance-Charity-Chastity – Equality-Pardon (Forgiveness)
FiveessentialQualitiesacquiredthroughMeditation:Perspicacity – Magnanimity – Receptivity-Adaptability-Creativity(ImprovedMemoryPower)

Total periods: 30

REFERENCE BOOKS:

1. Yoga for modern age - ThathuvagnaniVethathiri Maharishi
2. Simplified Physical Exercises - ThathuvagnaniVethathiri Maharishi
3. Kayakalpam - Thathuvagnani VethathiriMaharishi
4. Thirukkural -Rev.Dr.G.U.pope
5. Mind-ThathuvagnaniVethathiriMaharishi
6. SoundHealththroughyoga-Dr.Chandrasekaran
7. Light on yoga -BKS.lyenger
8. உணவுமுறை – தத்துவஞானிவேதாத்திரிமகரிஷி

BBT304	WASTE MANAGEMENT TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic of waste and its disposal				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES
To give a basic knowledge of waste handling and utilization

COURSE OUTCOMES (COs)

CO1	to understand the various types of waste
CO2	to know the various technologies to handle the waste material
CO3	To know the remedial measures for waste disposal
CO4	To get idea about industrial waste management
CO5	To know about bioremediation of waste
CO6	To understand about waste handling

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)				
					√								
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION 9

Introduction: Definition and Classification- Disposal methods: Land fill and Incineration – Recycling methods: biological reprocessing and Energy recovery-. Avoidance and Reduction Methods- Waste handling and Transport – Waste management Concepts

UNIT II AGRICULTURAL WASTE 9

Introduction- Waste Consistency- Waste Management Function: Production ,Collection, Storage, Treatment , Transfer, Utilization- Waste Management system Design – Waste Management System: Dairy Waste, Beef Waste, Swine Waste, Poultry Waste, Other animal – Municipal and Industrial Sludge- Food Processing – Agri-Chemical Waste Management- Handling.

UNIT III BIOMEDICAL WASTE 9

Introduction- Overview – Characterization of Medical Waste- Waste Generation Methodology – Sterilization- Chemical Disinfection – Thermal Inactivation- Irradiation- Microwave Treatment – Grinding and Shredding – Compaction- Current Practice – Standards .

UNIT IV INDUSTRIAL WASTE MANAGEMENT 9

Paper and Pulp Industry – Leather Industry – Cement Industry – Chemical Industry – fertilizer Industry – Pharmaceutical Industry – Textile industry – Iron and Steel industry – Mining Industry – Lignite industry – Petroleum Industry – Nuclear Industry.

UNIT V REMEDIAL MEASURES 9

Bioremediation – Phyto-remediation- Recycling of Plastic and Paper

TEXT BOOK:

1. Wang, Shannmas Hung, 2008, "Advanced hazardous industrial waste treatment" CRC Press.

REFERENCE BOOKS

1. Agricultural Waste Management Hand Book by USDA, III Ed,2005
2. Industrial Biotechnology Problems and Remedies by InduShekhar Thakur, VI Ed,2006

BBT306	PRINCIPLES OF CHEMICAL ENGINEERING	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engg Mathematics-I, Engg Mathematics -II, basics about unit operations				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES
To provide a basic knowledge of Process engineering

COURSE OUTCOMES (COs)

CO1	to understand the various unit operations involved in industry
CO2	to know the material balance for a process.
CO3	to know the energy balance for a process.
CO4	to get an idea about fluid mechanics.
CO5	to know about agitation and the types of agitators
CO6	to know about working principles of fermenter

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M			L	L	M
	CO2	H	M	M	H								
	CO3	H				H		M					M
	CO4	H	M		H	H							
	CO5	H	M	M		H		M					
	CO6	H			H			M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I OVERVIEW OF PROCESS INDUSTRY 12
Unit operations & Process - Conservation of mass & Energy -Stoichiometry- SI units & Conversion

UNIT II MATERIAL BALANCES 12

Overall and component material balances - Conversion -Yield - Selectivity - Material balances without chemical reactions and with chemical reactions

UNIT III ENERGY BALANCES 12

Energy - Forms of energy- Energy balances - Entropy - Latent heat -Hess's law- Standard heat of Reactions.

UNIT IV MOMENTUM TRANSPORT 12

Fluids-Types- Nature of flow-Momentum balance - Mechanical energy balance - Differential balances - Pressure losses in flow systems.

UNITVAGITATION AND TRANSPORTATION OF FLUIDS 12

Mixing and Agitation - Power consumption - Scale up - Pumps and gas moving machinery - Work of consumption.

TEXT BOOK

1. K.A.Gavhane, 2009, "Introduction to process calculations Stoichiometry" NiraliPrakasham Publications 22nd.

REFERENCE BOOKS

1. K.A. Gavhane, 2009, "Fundamentals of chemical engineering" NiraliPrakasham Publications 22nd.
2. McCabe and Smith,2002, "Unit operations in Chemical Enginering", Tata McHraw Hill Pblications, 6th Ed.
3. K.A. Gavhane, 2009, "Unit operations I Fluid flow & Mechanical operations" NiraliPrakasham Publications, 17th.
4. Bhat& Vora,2001, 'Stoichiometry", Tata McGraw Hill Ltd, III Ed
5. Weblink: nptel

BBT307	**GENERAL BIOCHEMISTRY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Chemistry and Biology				
	Course Designed by – Dept. of Industrial Biotechnology				

COURSE OUTCOMES (COs)	
CO1	to understand the fundamentals of biomolecules, their classification, structure
CO2	to apply the basic concept of carbohydrates, proteins ,lipids, nucleicacids and enzymes in metabolism.
CO3	to know the application of biomolecules in functioning of biological system
CO4	to get a basic knowledge of macromolecules in living organism and its energetic
CO5	To know basic concepts of enzymes

CO6	to understand the fundamentals function of biomolecules

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M				H						L
	CO2								H			H	
	CO3	H		H		H				H	H		H
	CO4	H	M				H	H					
	CO5	H										H	
	CO6	H		H					H		H		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
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4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CARBOHYDRATES 9

Significance and functions of carbohydrates structure and properties of monosaccharides: Glucose, Fructose, Galactose- Oligosaccharides: Sucrose, Lactose, Maltose, Raffinose- Polysaccharides: storage, structural, Homo, Hetero polysaccharides-Metabolism- Glycolysis, TCA cycle and Hexose Mono Phosphate pathway.

UNIT II LIPIDS 9

Structure and properties of Fatty acids – classification – Lipids – structure and properties of phospholipids- spingolipids, glucolipids and steroids-Biosynthesis and β oxidation of fatty acid.

UNIT III PROTEINS 9

Structure and properties of aminoacids – classification- peptides: chemistry and its properties- proteins: structures – properties – classification based on structure, function and nature. Biosynthesis of amino acid and catabolism-Urea cycle

UNIT IV NUCLEIC ACIDS 9

Structure and properties of purine and pyrimidine bases-Nucleosides- Nucleotides – Structure of DNA – various levels of organization of DNA – superhelical DNA – structure and properties of mRNA and rRNA-Biosynthesis and degradation of purine and pyrimidine

UNIT V ENZYMES 9

Classification and Nomenclature of enzymes- Properties of enzymes – active site -Factors affecting enzyme activity- Enzyme specificity- Mechanism of enzyme action- Enzyme kinetics related to Michaelis-Menten equation.

Text Book

1. 'Gaw A, 2008, "Clinical biochemistry" Elsevier Health Sciences, 4th.Ed.
2. J.L. Jain, 2008, "Fundamentals of biochemistry" S. Chand.8th Ed

Reference Books

1. J.L. Jain , , 2007 ,"Text Book Of Biochemistry' ,14th Ed
2. Zubey 2004 "Biochemistry" III Ed,
3. Voet&Voet 2006, "Biochemistry" V ed,.
4. Lehninger Nelson & Cox , , 2005 "Principles of Biochemistry",4th Ed
5. Weblink: nptel

BBT308	**GENERAL MICROBIOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic concepts in biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of microbes and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the source of microbes and their role in biotechnology
CO2	to get the knowledge of microbial diversity classification and morphology
CO3	to know the visualization of microbes by different microscopes
CO4	to know the cause, symptoms, diagnosis and treatment of diseases causing pathogens
CO5	to get a basic knowledge of the microbial nutrition and growth
CO6	To get knowledge about pathogens

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M			H	H	H	H		H
	CO2	H		M									
	CO3	H						H		H			H
	CO4	H		M	M			H					
	CO5	H				H	H						
	CO6	H		M	M					H			H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO MICROBIOLOGY 9

Definition-Scope and history of microbiology-prokaryotic and eukaryotic cell- different types of classification-Nomenclature-fermentation-pasteurization-role of microorganisms in pharmaceutical, food, agro and cosmetic industries-bioremedial applications-illustrations of genetically engineered strains

UNIT II GENERAL FEATURES OF MICROORGANISMS 9

Bacteria: diversity-classification-morphology-life cycle-Fungi: diversity-classification-morphology-life cycle-Algae: diversity-classification-morphology-life cycle-virus: diversity-classification-morphology-life cycle

UNIT III MICROSCOPY 9

Introduction- numerical aperture, resolving power-magnification- fixation, dyes and simple staining, differential staining- gram staining, acid-fast staining, Staining specific structures-negative staining, endospore staining, flagella staining-simple-compound-dark field-phase contrast-polarizing-fluorescent-laser optics-electron microscopy-scanning electron microscope-transmission electron microscope, specimen preparation-inverted microscope

UNIT IV MICROBIAL NUTRITION AND GROWTH 9

Common nutrient requirements-nutritional types of microorganisms, growth factors-uptake of nutrients by cells- culture media: synthetic or defined media-commonly used media-Types of media-selective-differential-enrichment media-aseptic techniques: disinfection-sterilization-cultivation of microbes: bacteria-fungi-viruses-pure culture: concept of pure culture-methods of pure culture of microorganisms–spread plate, streak plate and pour plate–microbial growth curve-factors affecting growth of microorganisms-measurement of growth

UNIT V MICROBIAL PATHOGENS AND DISEASES 9

Bacterial pathogens: *Staphylococcus aureus-Enterobacteriaceae*-Shigellosis-Fungal pathogens: superficial mycosis: Pityriasisversicolor-candidiasis-deep mycosis: Mycetoma-subcutaneous phycomycosis: Cryptococcosis-opportunistic systemic mycosis: aspergillosis, penicilliosis-mycotic poisons-Viral pathogens: Herpes, pox virus, AIDS virus, influenza virus

TEXT BOOKS

1. Michael J. Pelezar, J.R.E.C.S Chan, Noel R. Erieg, 2005, “Microbiology “ TATA McGraw Hill, 5th ed
2. Anantha Narayan, C.K. JayaramPaniker, 2009, “Text Book of Microbiology” Orient Blackswan, 7th ed

REFERENCE BOOKS

1. Presscott and Dunn, 2006, "Industrial Microbiology" CBS Publishers& Distributors.
2. Daniel V.Lim, "Microbiology", Kendall Hunt, 2002 ed
3. Weblink: nptel

BBT309	INSTRUMENTATION FOR BIOTECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – basic principles in instrumentation				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide a basic knowledge of the working principle of instruments and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of instruments and their different mode of applications
CO2	to know the principle, working concept and its applications
CO3	to find the various laboratory work based on instruments
CO4	to know the different types of instruments based on various parameters
CO5	to get a basic knowledge of equipments and their role in biological systems in relevant industries
CO6	To understand about working principles about instruments

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		H				H					
	CO2	H	H	H	H					H		H	
	CO3	H						H					
	CO4	H						H			M		
	CO5	H						H					
	CO6	H			H			H					H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I RADIATION TECHNIQUES 9

Sources of radiation- absorptivity-Lambert Beers law, deviations, detectors, photometric accuracy, Rayleigh scattering, Fourier transform, calibration and standardization, atomisation, flame atomisation, turbidimetric and nephlometric titrations -scattering in gases.

UNIT II ELECTROCHEMICAL TECHNIQUES 9

Principles: redox potential-pH electrode-ion selective and gas sensing electrodes-Clarke oxygen electrode and its application-biosensors.

UNIT III SPECTROSCOPIC TECHNIQUES 9

Colorimetry-UV-visible spectrophotometry-ORD-CD-X-ray spectroscopy-IR spectroscopy-ESR spectroscopy-NMR spectroscopy-Mass spectroscopy

UNIT IV SEDIMENTATION TECHNIQUES 9

Centrifugation principles-centrifuges and its types-differential and density gradient centrifugation-analysis of subcellular fractions-assessment of purity and determination of relative molecular mass

UNITV RADIOISOTOPE TECHNIQUES 9

Nature of radioactivity-Detection and measurement of radioactivity-GM counter-Scintillation counting-photographic emulsions-radiotracer techniques-autoradiography

TEXT BOOK

1. Willard and Merrit, "Instrumental Methods of Analysis", VI Edition, CBS Publishers and Distributors.
2. Asokan, Practical Biochemistry, IV edition

REFERENCES

1. Ewing GW, "Instrumental Methods of Chemical Analysis", McGraw Hill Book Company, 1989.
2. Braun H., "Introduction to Chemical Analysis", McGraw Hill, 1987.
3. Keith Wilson and Walker, Practical Biochemistry, V edition, Cambridge editions.

BBT310	IMMUNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – basics of immune system				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biological defense mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of immune system

CO2	to apply the techniques for antigen and antibody reaction
CO3	to give the mechanism of immune response against antigens
CO4	to know the natural barrier against pathogens
CO5	to get a basic knowledge of the applications of immunology in transplantation
CO6	To understand about techniques in immunology

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						H		H			
	CO2	H		H				H		H			
	CO3	H		H				H		H			
	CO4	H		H	M			H		H			
	CO5			H		H	H	H	H				H
	CO6	H				H		H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I THE IMMUNE SYSTEM 9

Introduction, Immunity, antigens &their classification, complement and their biological functions, types of immune responses, anatomy of immune response.

UNIT II HUMORAL IMMUNITY 9

B-lymphocytes and their maturation, activation &differentiation, structure and function of immunoglobulin, immunoglobulin classes, antibody production, mono-clonal antibodies and diagnosis major histocompatibility complex

UNIT III CELLULLAR IMMUNOLOGY 9

T -Lymphocytes their classification, maturation, activation & differentiation, antigen presenting, cells (APC), macrophages, langerhans cells, their origin and function, mechanisms of phagocytosis, Cytokines and their role in immune response, immunosuppression, immune tolerence

UNIT IV ANTIGEN - ANTIBODY INTERACTION AND HYPERSENSITIVITY9

Principle and application: Precipitation- immuno diffusion &widal test, Agglutination reactions, radio immuno assay, ELISA, Complement fixation test, Immuno fluorescence technique, Immunoelectrophoresis-Hypersensitivity reactions

UNITV TRANSPLANTATION AND AUTO IMMUNITY 9

Graft rejection, evidence and mechanisms of graft rejection, prevention of graft rejection-immunosuppressive drugs, mechanisms of immunity to tumour antigens. Auto antibodies in humans, pathogenic mechanisms -autoimmune diseases- treatment of auto immune disorders

TEXT BOOKS:

1. Janis Kuby,2007, "Immunology" W.H. Freeman & Co. 6th ed.
2. Roitt I, 2001, "Essential Immunology". Blackwell Scientific Publications, Oxford,

REFERENCES:

1. Tizard, 1992, "Introduction to Immunology" Saunders collage publication, 3rded.
2. Abbas,2009, "Basic Immunology" W.B. Saunders Company, 2nded.

BBT3L3	BIO CHEMISTRY LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic concepts in chemistry and biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic knowledge of biochemical components and its functions and their Applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of biomolecules, their classification,structure and functions
CO2	to apply the basic concept of carbohydrates, proteins,lipids, nucleicacids and enzymes in metabolism
CO3	to know the application of biomolecules in functioning of biological system
CO4	to get a basic knowledge of macromolecules in living organism and its energetics
CO5	To know basic concepts of enzymes
CO6	To understand about compound identification

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	H			H			H	H	
	CO2	H	H	H	H			H			H	H	
	CO3	H	H	H	H			H			H	H	
	CO4	H	H	H	H			H			H	H	
	CO5	H		H				H			H	H	
	CO6	H	H				M	M	M				

3	Category	Hum	Bas	Eng Sc	Profes	Core	Non-	Open	Proj/E
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Preparation of normal, molar and percent solutions.
2. Preparation of different buffer solution and measure pH.
3. Qualitative analysis of Unknown sugar- Monosaccharides,disaccharides and polysaccharides.
4. Estimation of sugar- Benedicts method.
5. Qualitative of unknown protein- Albumin,casein and gelatin.
6. Quantitative test for aminoacids- Ninhydrin method.
7. Quantitative test for protein – Biuret method.
8. Quantitative test for protein –Lowry method.
9. Quantitative test for protein – Bradford method
10. Spectrophotometric analysis of DNA.

BBT3L2	INSTRUMENTAL METHODS OF ANALYSIS LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic chemistry and physics				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic knowledge of the working principle of instruments and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	To understand the fundamentals of instruments and their different mode of applications
CO2	to know the principle, working concept and its applications
CO3	to find the various laboratory work based on instruments
CO4	to know the different types of instruments based on various parameters
CO5	to get a basic knowledge of equipment and their role in biological systems in relevant industries
CO6	To understand about basic working principles of equipment

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H					H				M	

	CO2	H		H	L			H	L		L		H
	CO3	H	H			L		H		L		M	
	CO4	H	H				L	H				M	L
	CO5	H	H					M				H	
	CO6	H	M			M				M			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1.Working principle of colorimeter and spectrophotometer
2. Difference between the spectrophotometer and colorimeter.
3. Validating beer lamberts law using colorimeter-potassium permanganate
4. Validating beer lamberts law using colorimeter-copper sulphate
5. Validating beer lamberts law using colorimeter-potassium dichromate
6. Determination ofλ max.
7. Estimation of SO^{2-}_4 by nephlometry
8. Measurement of turbidity in water by nephlometry
9. Measurement of hydrogen ion in water samples
10. Preparation of buffer
11. Determination of moisture content
12. Precipitation of protein using ammonium sulphate.

BBT3L1	**CELL BIOLOGY LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – basic cell biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge about cell biology

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of instruments and their different mode of applications
CO2	to get idea about slide preparation
CO3	to know about blood grouping
CO4	to get knowledge about mitosis
CO5	to get a basic knowledge of extraction of plant pigments
CO6	To understand about preservation technique

		Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low											
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		H	H			H					
	CO2	H	H					H	M				
	CO3	H			H	H	H	H					
	CO4	H						H					
	CO5	H						H					
	CO6	H			H			H					
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term paper Seminar/ Internship (PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

LIST OF EXPERIMENTS

1. Study of Microscope
2. Spotters
3. Permanent Slide preparation
4. Killing and Fixing
5. Mitosis on onion root tip
6. Cryopreservation
7. Preparation of Blood smear
8. Separation of plasma and serum from blood sample
9. Total RBC and WBC Count
10. Osmosis
11. Extraction of pigments

BBT401	**BIOORGANIC CHEMISTRY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basics of biochemistry				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biochemical reactions, mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of biochemical reactions in living organism
CO2	to apply the concept of structural relationship between chemical and biochemical reactions
CO3	to create the drug formulation and its structural analogs in living systems comprehend genetics and the immune system
CO4	to know the role of metal ions in biological components and their importance in living systems

CO5	to get a basic knowledge of membrane transport and their permeability
CO6	To understand basic concepts of drug

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			H		H					
	CO2	H							H		H	H	H
	CO3	H		H	H	H	H	H				M	
	CO4	H						M					
	CO5	H						H					
	CO6	H		H						H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNITI INTRODUCTION TO BIOORGANIC CHEMISTRY 9

Basic considerations, Proximity effect, Molecular adaptation, Molecular recognition, supramolecular chemistry, Chemistry of living cells, Analogy between biochemical transformations and bioorganic reactions.

UNIT II BIOORGANIC CHEMISTRY OF AMINO ACIDS AND PEPTIDES 9

Chemistry of Peptide bond synthesis- Asymmetric synthesis of amino acids - different models, Transition state analogous, chemical mutations, site specific mutagenesis, Molecular recognition and drug design, Catalytic antibodies.

UNIT III ENZYME CHEMISTRY 9

Introduction to enzymes, Types of enzymes- Immobilized enzyme- Semi synthetic enzymes- Mechanism of enzyme action- Allosteric regulatory enzymes.

UNIT IVMETAL IONS IN BIOLOGICAL SYSTEMS 9

Metal ions in proteins -Role on Zinc in carboxy peptidase- Iron and oxygen transport in Haemoglobin- Metal ion act as co-enzymes & Co factors in a biological reaction & Respiratory chain

UNIT V MEMBRANE CHEMISTRY 9

Structure- Active & Passive transport- ATP driven pumps – Ligand gated channels – Voltage gated channels.

TEXT BOOK

1. Dugas. H, Bio-Organic Chemistry - A chemical approach to enzyme action, Springer Verlag,

2002, revised edition.

REFERENECE BOOKS

1. Faber. K, Biotransformations in Organic Chemistry- A text book, 4th Edition, Springer
2. Zubay .G. Bio chemistry, Max well Macmillan Publications, 2003 edition.
3. Weblink: nptel

BBT403	**INTRODUCTION TO INDUSTRIAL BIOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic cell biology, genetics and biology				
	Course Designed by – Dept. of Industrial Biotechnology				

COURSE OUTCOMES (COs)	
CO1	to understand the objective and scope of biotechnology
CO2	to know the concept of cell culture techniques
CO3	to comprehend DNA and its role in functioning of a cell
CO4	to know the microbial production
CO5	to get an idea about the applications of biotechnology
CO6	To get knowledge about vaccination

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						H	H				H
	CO2	H				H		H				H	
	CO3	H	H	H				H					
	CO4	H		H				H		H		H	M
	CO5	H								H	H	M	H
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Introduction to Industrial Biotechnology - Objectives and Scope: Characteristics and comparison of bioprocessing with chemical processing – Strain improvement.

UNIT II CELL CULTURE 9

Basics of Cell Culture, Cell culture techniques in microorganisms. Preservation and improvement of industrial microorganisms

UNIT III BIOPROCESS 9

Process Technology, Development of inocula for industrial fermentation and some primary metabolites e.g. ethanol, acetone - butanol and citric acid

UNIT IV INDUTRIAL BYPRODUCTS 9

Microbial Production- Microbial production of industrial enzymes - glucose isomerase, proteases, Streptokinases Production of Vit B_{12} and secondary metabolites- penicillin, Streptomycin

UNITV APPLICATIONS OF BIOTECHNOLOGY 9

Application of Biotechnology in Human Welfare- Human health care -insulin, interferon, monoclonal antibodies etc- Development of vaccines for immunity - Bacterial and viral vaccines, Crop improvement- Disease, pest, herbicide resistance

TEXT BOOK:

S.N. Joganand, 2003, "Environmental Biotechnology"Himalaya publishing House, IV ed.

REFERENCE BOOKS:

1. Saha BC,2003, “Fermentation biotechnology” Americal Chemical Society.
2. Vyas SP,2002, “Methods in biotechnology and bioengineering” CBS Publishers & Distributors.
3. Acharya R, 1999, “The emergence and growth of biotechnology” E.Elgar.
4. Jain PC, 2004, “Microbiology and biotechnology for sustainable development” CBS Publishers & Distributors.
5. Stanbury Whittaker, 2002, "Principles of fermentation technology" - II Edn.
6. Weblink: nptel

BBT404	**PRINCIPLES OF CHEMICAL THERMODYNAMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Basic concepts in chemical engineering				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge of thermodynamics

COURSE OUTCOMES (COs)

CO1	to understand the basic concepts in thermodynamics
CO2	to know the properties of fluid
CO3	to know to get an idea about application of thermodynamics in various field
CO4	to get knowledge about reaction equilibrium
CO5	to know about applications of thermodynamics law

CO6	To understand about properties of pure liquids

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		H				H	M				M
	CO2	H				L		H			H		
	CO3	H			L			H	H	H	H	H	
	CO4						L						L
	CO5	H	H		H			H					
	CO6	H				L		H	L		H		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)

4	Approval	37th Meeting of Academic Council, May 2015

UNITI BASIC CONCEPTS IN THERMODYNAMICS 12

Scope and limitations- Definitions and Fundamental concepts - Calculation of force, pressure and energy - Phase rule -Zeroth law- Heat reservoirs & Heat engine -First law- First law for non-flow process- enthalpy- First law for flow process.

UNIT II PVT BEHAVIOUR AND FIRST LAWOF THERMODYNAMICS 12

PVT behavior of pure liquids - Equations of state- Constant volume process , constant pressure process and constant temperature process- Vander Waals equation- Virial equation.

Second law- Mathematical statement of second law- Kelvin and Clausius statement- Clausius inequality

UNIT III THERMODYNAMIC PROPERTIES OF PURE LIQUIDS 12

Classification of properties- Helmholtz free energy - Gibb's free energy-Fundamental property relations- Maxwell equations - Clapeyron equation -Relationship between Cp and Cv- Fugacity and fugacity coefficient- Effect of temperature and pressure on fugacity- Activity and Activity coefficient-Effect of temperature and pressure on Activity.

UNIT IV CHEMICAL REACTION EQUILIBRIUM 12

Reaction stoichiometry -Equilibrium constant and standard free energy change - Effect of temperature on equilibrium constant- Evaluation of equilibrium constant - Effect of pressure on equilibrium - Other factors affecting equilibrium conversion.

UNITV APPLICATIONS OF THE LAWS OF THERMODNAMICS 12

Energy equation - Ejectors - Throttling process - Compressors - Adiabatic and Isothermal compression - Refrigeration - Choice of refrigerant -Absorption refrigeration- COP- Carnot cycle- Heat pumps.

TEXT BOOK

1. K.V.Narayanan, 2004, "Chemical Engineering Thermo Dynamics" Prentice Hall of India Pvt Ltd.

REFERENCCE BOOKS

1. K.A.Gavhane, 2009, "Chemical Engineering Thermodynamics" NiraliPrakasham Publications, 20th.
2. T.M.Letcher, 2004, "Chemical thermodynamics for industry" R.S.C Publication 3rd.
3. Weblink: nptel

BBT405	UNIT OPERATIONS	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engg Mathematics-I& III, Principles of Chemical Engineering				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To give a knowledge of heat and mass transfer

COURSE OUTCOMES (COs)

CO1	to understand the basic concepts in heat transfer
CO2	to know basic concepts of evaporation
CO3	to know about mass transfer operations
CO4	to know about leaching and extraction
CO5	to know about various drying
CO6	To understand about the size reduction equipment

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				H		H		L	L		L
	CO2	H	H					H					
	CO3	H	H					H		M			M
	CO4		H	H	H						H	M	
	CO5	H			H			H					
	CO6	H		H				H				M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT IHEAT TRANSFER **12**

Modes of heat transfer- Heat transfer through compound wall- Heat flow through cylinder- Definition of Boiling, condensation and its types.

UNIT IIHEAT EXCHANGERS **12**

Heat exchanger- Theory of Shell and Tube heat exchanger and double pipe heat exchanger- Derivation of Overall heat transfer coefficient - LMTD.

Evaporator- Types: falling film- Climbing film. Forced circulation and Agitated film evaporator- Methods of feeding

UNIT IIIMASS TRANSFER **12**

Outline of Mass transfer operations- Diffusion in Gases, Liquids & Solids. Distillation- Theory of Simple, Flash, Steam and Azeotropic distillation-McCabeThiele method

UNIT IVLEACHING **12**

Leaching- Theory of Moving bed leaching and Dispersed solid leaching. Liquid extraction- Mixer settler- Spray and packed extraction tower-Agitated extraction tower.

UNITVDRYING **12**

Drying- Drying equipment: Tray, Screen-conveyor, Rotary and Spray dryer-Selection of drying equipment- Time of drying.

Size reduction -Laws- Work index-Size reduction equipment: Jaw crusher. Smooth roll crusher- Tumbling mill - Fluid energy mill - Knife cutters-open and Closed circuit operation

TEXT BOOKS

1. Gavahnee, 2009,"Heat & Mass Transfer" NiraliPrakasham Publications, 20th Ed

REFERENCE BOOKS

1. K.A. Gavhane, 2009, "Unit operations II Heat & Mass Transfer" NiraliPrakashamPyblications, 23rd Ed
2. G.S. Sawhney, 2008,"Heat & Mass Transfer" I.K. International Publishing House
3. McCabe W. L & Smith J. C., "Unit operations in chemical Engineering". V.Ed..McGrawHillInt Ed.,
4. Robert e.Treybal,2000, "Mass Transfer Operations", McGraw Hill International III edition.
5. Christie J. Geankoplis,2000 " Transport Processes and Unit Operations", Prentice Hall India PvtLtd, III Edtion,
6. Weblink: nptel

BBT406	INTRODUCTION TOMOLECULAR BIOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic concepts in Biology, Microbiology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of molecular level of DNA and their applications from the

perspective of engineers	
COURSE OUTCOMES (COs)	
CO1	to understand the fundamentals of central dogma of biological systems
CO2	to know the concept of cell replication,transcription and translation
CO3	to comprehend DNA and its role in functioning of a cell
CO4	to know the functioning of regulatory factors and its application in maintaining cell activity
CO5	to get a basic knowledge of the DNA and RNA
CO6	to get a basic knowledge of the proteins

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H				H				H	H
	CO2	H			H		H						
	CO3	H	M			H		H	H		M		
	CO4	H	M									H	
	CO5	H					H			H			
	CO6	H	M			H						H	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I DNA STRUCTURE 9

DNA as the vehicle of inheritance-structure of DNA-forms of DNA-nucleic acid biosynthesis-experimental evidence: Griffith, McLeod, McCarty and Avery, Hershey–Chase experiments-Definition of gene-organization of genes and non coding DNA in prokaryotes- Eukaryotes–unique, moderately repetitive and highly repetitive DNA sequence-satellite DNA- Cot value-DNA binding proteins

UNIT II DNA REPLICATION 9

DNA replication in prokaryotes and eukaryotes- modes of replication-semi continuous and semi discontinuous replication- Okazaki fragments- RNA primers – enzymes of replication – DNA polymerases I, II, III, -DNA modifying enzymes: topoisomerases-helicases- binding proteins and ligases- replication in E.coli–replisomes-events at OriC (initiation), events on the replication fork (elongation) and termination- Fidelity of replication-Sigma or rolling circle mode of replication in Φ x 174-Inhibitors of replication.

UNIT III DNA REPAIR 9

Repair of DNA–types of damages- repair by direct reversal of damage- excision repair- recombination repair- SOS repair-Mutation: definition-type of mutations (spontaneous and induced) point mutation-Gene mutation and chromosomal aberrations- Cause of mutations-chemical and physical agent

UNIT IV TRANSCRIPTION 9

Transcription in prokaryotes and eukaryotes: RNA polymerases–enzyme structure- role of sigma factor- promoter-closed and open promoter complexes-Initiation-elongation and termination of RNA synthesis-Post transcriptional modification in prokaryotes and eukaryotes-transcription factors

UNIT V GENETIC CODE 9

Genetic code–Basic features of genetic code-Deciphering of genetic code-Wobble hypothesis-Protein biosynthesis-activation of amino acids- initiation-elongation and termination of translation in prokaryotes and eukaryotes-Post translational modifications-Inhibitors of translation.-Regulation of gene expression in prokaryotes and eukaryotes- operon concept

TEXT BOOKS

1. Biochemistry by Jeremy M. Berg, John L. Tymoczko and LubertStryer, 2006
2. Lehninger, Principles of Biochemistry, David L. Nelson and Michael M. Cox, 2008
3. James D. Watson, Tania A. Baker, Stephen P. Bell, and Alexander Gann, Molecular Biology of the Gene (6th ed), 2007

REFERENCE BOOKS

1. R.L. Adams, J.T. Knowler, and D.P. Leader, The Biochemistry of the Nucleic Acids, 1992
2. Stephen Neidle, Principles of Nucleic Acid Structure, 2007
3. Robert Weaver, Molecular Biology, 2007
4. Weblink: nptel

BCE406	**ENVIRONMENTAL STUDIES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – Physical Sciences				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To study the nature and facts about environment.
2. To find and implement scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth's interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

COURSE OUTCOMES (COs)

CO1	Play an important role in transferring a healthy environment for future generations
CO2	Analyze the impact of engineering solutions in a global and societal context

CO3	Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO4	Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO5	Highlight the importance of ecosystem and biodiversity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance, Need for public awareness.

Natural Resources : Renewable And Non – Renewable Resources

Natural resources and associated problems

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effect on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, flood, drought conflicts over water, dams-benefits and problems.

c) Mineral resources : Uses and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes caused by agriculture and overgrazing , effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, Land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conversation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 8

Concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)-
Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III BIODIVERSITY AND ITS CONSERVATION 7

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega-diversity nation, Hot-spots of biodiversity -Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution 7

Definition, Causes, effects and control measures of ;- Air Pollution, Water pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management : Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster Management : floods earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 8

From Unsustainable to Sustainable development, Urban problems related to energy, nuclear accident and holocaust, case studies, wasteland reclamation, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife protection Act, Forest Conservation Act, Issues involved in enforcement of environmental Legislation, public awareness –
Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel –oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder- Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes – Noise produced by fire crackers – Noise pollution – Noise level standards for fire crackers – Intensity of sound – Impact on hearing – Safety measures.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations, population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

TEXTBOOKS:

1. Gilbert M.Masters, “Introduction to Environmental Engineering and Science”, Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
3. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad – 380 013, India, 1989.

4. Benny Joseph, "Environmental Studies"., TATA McGraw Hill, 2010

REFERENCES

1. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, EnviroMedia 2009
2. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
4. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno Science Publications 2013
5. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB),2001.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
8. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
9. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publish Co. Pvt. Ltd. 345p.
12. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut.
13. http://eng.mft.info/uploadedfiles/gfiles/c8e31c9e52d84c3.pdf

BBT4L1	Microbiology Lab	0	0	3	2
	Total Contact Hours - 45				
	Prerequisite- Microbiology, Molecular biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES-

To provide a basic understanding of microbes and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the source of microbes and their role in biotechnology
CO2	to get the knowledge of microbial diversity classification and morphology
CO3	to know the visualization of microbes by different microscopes
CO4	to know the cause, symptoms, diagnosis and treatment of diseases causing pathogens
CO5	to get a basic knowledge of the microbial nutrition and growth
CO6	To understand about various identification methods of microorganisms

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1											H	
	CO2	H						H					
	CO3	H	H										
	CO4									L			
	CO5						L						L
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Laboratory rules and regulations
2. Isolation of Bacteria Soil
3. Motility of Bacteria
4. Staining techniques
5. Streak Plate techniques
6. Antibiotic sensitivity test
7. Isolation of Fungi
8. Water analysis by MPN
9. Milk Analysis
10. Biochemical Analysis

BBT4L2	**BIOORGANIC CHEMISTRY LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Biochemistry, Bioorganic chemistry				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biochemical reactions, mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of biochemical reactions in living organism
CO2	to apply the concept of structural relationship between chemical and biochemical reactions
CO3	to create the drug formulation and its structural analogs in living systemscomprehend genetics and the immune system
CO4	to know the role of metal ions in biological components and their importance in living systems
CO5	to get a basic knowledge of membrane transport and their permeability
CO6	To understand about extraction of various compounds

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H	H	H		H	H				H
	CO2		H	H			M					M	
	CO3	H		M	M	H					M		
	CO4		L	L				L	L	L			L
	CO5			H	H		M			H		M	M
	CO6	M	M	M					M		M	M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Preparation of casein from milk.
2. Separation of starch from potato.
3. Extraction of chlorophyll in plant tissue.
4. Extraction of lactose from milk.
5. Estimation of glucose from grapes.
6. Extraction of fructose from honey.
7. Extraction of lycopene from tomato.
8. Acetylation of D-glucose.
9. Preparation of methyl salicylate from aspirin.
10. Preparation of aspirin from salicylic acid.

BBT4L3	**MOLECULAR BIOLOGY LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic concepts in biotechnology, microbiology and molecular biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of molecular level of DNA and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of central dogma of biological systems
CO2	to know the concept of cell replication,transcription and translation
CO3	to comprehend DNA and its role in functioning of a cell
CO4	to know the functioning of regulatory factors and its application in maintaining cell activity
CO5	to get a basic knowledge of the DNA and RNA
CO6	to get a basic knowledge of the proteins

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				H			H	M		M	
	CO2			H	M		M						L
	CO3	H				H							H
	CO4	H		M	H		H		H	M			
	CO5			H			H				H		H
	CO6	H		H		H			H			M	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term paper Seminar/ Internship (PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

LIST OF EXPERIMENTS

1. Extraction of plant genomic DNA.
2. Extraction of Bacterial genomic DNA
3. Extraction of Animal DNA
4. Agarose gel electrophoresis.
5. Restriction Digestion of DNA.
6. Ligation of E-CoR1 digest of λDNA
7. Isolation of plasmid DNA by alkaline lysis
8. Effect of UV radiation on bacterial survival (induced mutagenesis.
9. Transformation.
10. Poly acrylamide –SDS slab gel electrophoresis of proteins

BBT4S1	**TECHNICAL SEMINAR I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – General Biochemistry, General Microbiology, Cell Biology				
	Course Designed by– Dept. of Industrial Biotechnology				

OBJECTIVES

To enable students to create the habit of exploring new avenues of biotechnology and to improve their presentation skills

COURSE OUTCOMES (COs)

- It is a one credit course offered in the IV Semester
- Each student will be allocated topics for presentation
- There are 2 hours allocated per week for the students give their presentation. This will be considered for the award of internal marks.
- The final topic will be presented on the day of the external examination in the presence of the internal examiner. The student will be judged based on the presentation and how he or she defends the selected topic.

BMA501	**BIOSTATISTICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engg Mathematics-I &II				
	Course Designed by – Dept. of Mathematics				

OBJECTIVES

To provide a basic knowledge of probability and statistics

COURSE OUTCOMES (COs)

CO1	to understand the basic concepts various theorem in probability
CO2	to know basic concepts random variables
CO3	to know about sampling concepts
CO4	to know about design of experiments using various test.
CO5	to know about various testing methods
CO6	To know about various process for statistics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M			H	H	L	L	H
	CO2	H	M	M				H					
	CO3	H			H	H	H	H			L	L	M
	CO4	H	M			H			H		L	H	M
	CO5	H	M	M	H	H		M					
	CO6	H			H		M	M		H	M	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNITI RANDOM VARIABLES 12

Probability and Random Variables - Probability concepts, Baye's Theorem, Random Variables, Discrete and continuous Function of random variables- Moment generating function of binomial, Poisson, Geometric. Uniform, Exponential Distributions, Normal Distribution (Problems)

UNIT II DISTRIBUTION AND EXPECTATION 12

Two Dimensional Random Variables - Marginal and conditional Distributions, Expectation and conditional Expectations, Transformation of Two dimensional Random Variables, Central Limit Theorem (Statement and Problems)

UNIT III SAMPLING 12

Sampling Concepts - Methods of sampling. Simple random sampling, Stratified random sampling, Systematic sampling, Point and Interval estimators. Properties of Estimators, Sample size determination, testing of hypothesis, Small samples (t test). Large samples (Z test), Confidence limits

UNIT IV RANDOM PROCESSES 12

Random Processes - Classification stationary and Markov Process, Poisson Processes, Markovian chains, Markovian Quenching models, infinite and finite with single server

UNITV DESIGN OF EXPERIMENTS 12

Design of Experiment and Non Parametric Test - Completely randomised design, Randomised block design, Latin Square design- Sign Test, KolmogrovSmirovTest, Mann Whitney U test, KniskalWallisTest

Text Book

1. Kapur J. N and Saxena H. C, "Mathematical Statistics", S. Chand and Co., New Delhi

Reference Books

1. Veerarajan T, "Probability Statistics and Random Process" Tata McGrawHill, New Delhi
2. S.C. Gupta and V.K. Kapoor, "Applied Statistics", S. Chand and Sons, New Delhi
3. W. W. Daniel, "Biostatistics- A foundation for analysis of health sciences", John Wiley and Sons, New Delhi
4. P.N. Arora and S. Arora, "Statistics for Management", S. Chand and Sons, New Delhi

BBT501	GENETIC ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Molecular biology, Cell biology, Microbiology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of recombinant mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of genetic engineering
CO2	to apply the concept of recombinant DNA IN plant, animal and microbial systems and growth in real life situations

CO3	to get the knowledge of molecular scissors and its role in creating transgenic products
CO4	Toknow the techniques related to screen the recombinant products
CO5	to get a basic knowledge of the applications of transgenes in agriculture, health care and biological products in relevant industries
CO6	to know about gene transfer methods

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	H	H	L	H
	CO2	H	M	M	H	H	M	M	H		L		
	CO3	H	M		H					H	M	L	H
	CO4	H	M			H	H	M	M		M	M	M
	CO5	H	M	M		H		M		M		L	H
	CO6	H			H	H			L				M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
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4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BASICS OF GENETIC ENGINEERING 9

Introduction to Genetic engineering; Role of genes within cells- method of creating recombinant DNA molecules.-Role of vectors plasmid, cosmid, BAC, YAC etc.-Restriction enzymes and mapping of DNA-Role of Transposons in genetic engineering-Safety guidelines of creating recombinant DNA research.

UNIT II CONSTRUCTION OF cDNA LIBRARIES 9

Characterization of recombinant clones by Southern, Northern, Western and PCR analysis. Construction of genomic and cDNA libraries, methods of nucleic acid sequencing, factors involved in expression of cloned genes.

UNIT III APPLICATION OF rDNA TECHNOLOGY IN PLANTS 9

Method of gene transfer to plants- agrobacterium mediated / chemical mediated, Biolistics. Transgenic plants- Ri and Ti plasmids, Screening of recombinants, Biopharmaceuticals, Single cell proteins.

UNIT IV APPLICATION OF rDNA TECHNOLOGY IN ANIMALS 9

Animal cloning, Ethical aspects of animal cloning,-Transgenic animals- sheep, goat, cattle, fish etc-Methods of gene transfer to animals-embryo transfer.

UNITV APPLICATIONS OF rDNA TECHNOLOGY ININDUSTRY 9

Health care: Vaccines, hormones, antibiotics & pharmaceuticals- Industrial enzymes and agriculture.

TEXT BOOK

1. Brown TA, 2000, "Gene cloning-and introduction" VNR (U.K) Co Ltd.

REFERENCE BOOKS

1. Setlow JK,2004, "Genetic engineering: principles and methods" Springer.
2. Fridal R,2006, "Genetic engineering" Lerner publications.
3. LeVine H,2006, "Genetic engineering-A reference handbook" ABC-CLIO.
4. Levine AD,2009, "Cloning" The Rosen publishing group, 1st.
5. Weblink: nptel

BBT502	**PRINCIPLES OF BIOPROCESS TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engg Mathematics-I &II, Principles of Chemical Engineering.				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge of Biological processes.

COURSE OUTCOMES (COs)

CO1	to understand the development of bioprocess techniques.
CO2	to know about the instrumentation and control for bioprocess operations
CO3	to get idea about media formulations
CO4	to know about stoichiometry of bioprocess.
CO5	to know about various bioreactors
CO6	to know about the importance of sterilization.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H		H	H	H	H	M	L	M
	CO2	H	M	M	H							L	M
	CO3	H				H			H	L			
	CO4	H	M				M	M				L	
	CO5	H	M	M		H				M	L		
	CO6	H				H		L	M		L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
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4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO BIOPROCESSES 9

Historical development of bioprocess technology, an overview of traditional and modern applications of biotechnological processes, Biotechnology & Bioprocess engineering- outline of Unit Operations involved in Upstream and Downstream processing, generalized process flow sheets.

UNIT IIOPERATION AND CONTROL OF BIOREACTOR 9

Overview of reactor- -General requirements of fermentation processes, Basic design and construction of fermentor and ancillaries. Main parameters to be monitored and controlled in fermentation processes- solid-substrate fermentation and its applications

UNIT III GROWTH MEDIA AND STERILIZATION 9

Medium requirements for fermentation, Carbon, Nitrogen, Minerals, Vitamins, and other complex nutrients, Oxygen requirements, medium formulation - Simple and complex media- Batch and continuous heat sterilization of liquid media, filter sterilization of liquid media.

UNIT IV STOICHIOMETRY OF MICROBIAL GROWTH 9

Stoichiometry of Cell growth and product formation- elemental balances- degrees of reduction of substrate and biomass-available electron balances-yield coefficients of biomass and product formation

UNITV BIOREACTOR DESIGN 9

Reactor engineering in perspective- Cost determining factor in design- Bioreactor configuration- Practical consideration for bioreactor construction- inoculation and sampling from fermentor- materials of construction- Steps involved in fermentor design.

Text Book

1. Shuler and Kargi, 2005 "Bioprocess Engineering",Prentice Hall

Reference books

1. Bailey and Ollis, 2000, "Biochemical Engineering Fundamentals", McGraw Hill 3rded.
2. Stanbury PF,1984, “Principles of fermentation technology” SS Hall, 2nd.
3. Mansi El Mansi.2003 “Fermentation Microbiology & Biotechnology”.IVEd.
4. P.T. Kalaichelvan and I. Arul Pandi. 2007 “Bioprocess technology” MJP Pub, 1sted.

BBT503	CHEMICAL REACTION ENGINEERING	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engg Mathematics-I &II, Unit operations				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge of Reaction engineering

COURSE OUTCOMES (COs)

CO1	to understand basic concepts in homogenous reactions
CO2	to know about various order reaction
CO3	to know about the plug flow and mixed flow reactor
CO4	to know about multiple reactors
CO5	to know about design of bioreactors
CO6	to know about rate of a reaction

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	H	H	M	M
	CO2	H		M	M	H	M					M	
	CO3	H	M			H			M	M	M		H
	CO4	H			M	M	M		M			L	M
	CO5	H	M	M	M	L		L	L	L	M	M	L
	CO6	H	L	M				L					L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
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4	Approval	37th Meeting of Academic Council, May 2015							

UNITI KINETICS OF HOMOGENEOUS REACTIONS 12

Single and multiple reaction- Elementary and Non elementary reaction-Order &Molecularity-rate constant - Kinetics models for non-elementary reaction- searching mechanism for Irreversible and Enzyme catalyzed reaction- Theories of chemical reaction.

UNIT II INTERPRETATION OF BATCH REACTOR DATA 12

Methods: Integral and Differential – Constant Volume Batch reactor – Analysis of total pressure data in constant volume system- Rate Equation: Irreversible Unimolecular I and II order and irreversible bimolecular II order – half-life period – variable volume batch reactor.

UNIT III DESIGN OF SINGLE IDEAL REACTORS 12

Constant Density & Changing Density Batch and Flow system – Design of ideal batch reactor – Space time and Space velocity – Design of MFR & PFR

UNIT IV MULTIPLE REACTION AND NON IDEAL FLOW REACTOR 12

Comparison of MFR with PFR I order & II order – Reactor in series: CSTR in series –Unequal size CSTR in series, Equal size CSTR in series – PFR in series.

UNITV BIOREACTOR 12

Biochemical reaction: Bioprocess &Bio reaction- Cell multiplication kinetics- types of bioreactors- Some industrial application of bioprocess: Aerobic and anaerobic bioprocess.

TEXT BOOK:

1. K.A.Gavhane, 2009, "Chemical Reaction Engineering I" NiraliPrakasham Publications, 19th.

REFERENCE BOOKS:

1. K.A.Gavhane, 2009, "Chemical Reaction Engineering II" 21sted.
2. Octave Levenspiel, 2006, "Chemical Reaction Engineering" Wiley-India, 3rd Edition
3. Weblink: nptel

BBT505	**PLANT BIOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – General biology, Cell biology, Microbiology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge about plant tissue culture and its applications

COURSE OUTCOMES (COs)

CO1	to understand basic concepts in organization of plant genome
CO2	to know about the genetic engineering concepts involved in plant
CO3	to know about plant tissue culture
CO4	Toknow about bioremediation.
CO5	to understand the various applications of plant tissue culture
CO6	to know about gene transfer methods

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	M	L	L	H
	CO2	H	M	M	H	H	H	M	H	H	M	H	H
	CO3	H			H	H	H	M	M	M	L	L	M
	CO4	H	M	H	H	H	M	M	L	M	L	M	H
	CO5	H	M	M	H	H	M	M	M	M	H	L	M
	CO6	H			H	H		M			L	L	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PLANT MOLECULAR BIOLOGY 9

Plant genome organization – mitochondrial genome – cytoplasmic male sterility – chloroplast genome – post transcriptional modifications – transcription factors – gene silencing – regulation of gene expression – transposable elements

UNIT II PLANT GENETIC ENGINEERING 9

Plant viral vectors – Ri& Ti plasmid vectors – promoters used in plant vectors – methods of gene transfer- Agrobacterium mediated gene transfer –biolistics – latest methods of gene transfer in plants – Transposon tagging – selection of transformants/recombinants – RFLP, RAPD – plant pathogen interactions.

UNIT III PLANT TISSUE CULTURE 9

Basic terminologies – requirements of a plant tissue culture laboratory – Types of culture – selection of explants – sterilization techniques – Types of media – direct and indirect regeneration – micropropagation – haploid culture – protoplast culture – somatic hybridization and cybridization – embryo rescue – artificial seeds.

UNIT IV BIOCONTROL, BIOREMEDIATION AND BIOFERTILIZERS 9

Biochemistry and molecular biology of nitrogen fixation – transfer of nif genes – biocontrol of insect pests – genetic engineering of biocontrol agents – microbial pesticides – biofertilizers; types and applications – effluent treatment and using plant materials – phyto remediation.

UNIT V APPLICATIONS 9

Transgenic plants for insect, disease, stress & herbicide resistance – edible vaccines and antibodies – methods of crop improvement through genetic engineering - DNA finger printing – production of secondary plant metabolites through suspension cultures.

TEXT BOOKS

1. Adrian Slater, 2006, "Plant biotechnology", 3rd Ed,
2. Fr. S. Ignacimuthu, 2000 Plant biotechnology IV ed.

REFERENCE BOOKS

1. C. B. Nirmala, G. Rajalakshmi, Chandra Karthick. 2009," Plant Biotechnology"
2. Veereshem C, 2006, "Medicinal plant biotechnology" CBS Publishers & Distributors.
3. Weblink: nptel

BBT5L1	GENETIC ENGINEERING LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Molecular biology,rDNATechnology,Microbiology.				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of recombinant mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of genetic engineering
CO2	to apply the concept of recombinant DNA IN plant, animal and microbial systems and growth in real life situations
CO3	to get the knowledge of molecular scissors and its role in creating transgenic products
CO4	to know the techniques related to screen the recombinant products.
CO5	to get a basic knowledge of the applications of transgenes in agriculture, health care and biological products in relevant industries
CO6	To get knowledge about PCR

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H		H	M	H	H	L	L	M
	CO2	H	M				L		H	M	L		
	CO3	H	M	H	H	H	H	M	H	H	L		
	CO4	H			H	H	H	M	M	M		L	M
	CO5	H	M	M	H					L	L	L	
	CO6	H			H	H	H	M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Extraction of DNA
2. Agarose gel electrophoresis
3. Restriction digestion of DNA
4. Ligation of digested DNA
5. Preparation of competent cell
6. Transformation
7. Southern hybridization
8. AFLP
9. GFP cloning
10. Polymerase Chain reaction

BBT5L2	CHEMICAL ENGINEERING LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – principles of chemical engg,chemical reaction engg,mechanicaloperations, Mass&Heat Transfer				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES:To provide a knowledge about heat, mass transfer and reaction kinetics

COURSE OUTCOMES (COs)

CO1	to get knowledge about reactor kinetics
CO2	to know about drying equipment
CO3	to get idea about heat transfer
CO4	to know about mass transfer operations
CO5	to understand about mechanical operations
CO6	To know about the basic Technical analysis methods

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						H	L		H		L
	CO2			L		M				L		L	
	CO3	H	L		M		H	H			H		L
	CO4								M	L			
	CO5	H		M							H		
	CO6	H	L					H				L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Batch Reactor I
2. Batch Reactor II
3. Drying studies in Tray dryer
4. Simple Leaching
5. Adsorption
6. Heat transfer through Natural convection
7. Heat transfer through Forced convection
8. Heat transfer through composite wall
9. Sieve Shaker Analysis
10. Magnetic Separator
11. Analysis of chloride content in Cement
12. Analysis of chlorine content in Bleaching Powder

BBT5L3	PLANT AND ANIMAL BIOTECHNOLOGY LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Plant biotechnology, Animal biotechnology, Genetic engineering				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide a basic understanding of plant and animal cell culture techniques

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of plant biotechnology
CO2	to know about sterilization techniques
CO3	to know about plant tissue culture
CO4	to know about animal cell culture
CO5	to get a basic knowledge of the applications using plant biotechnology
CO6	to get a basic knowledge of the applications using animal biotechnology

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M	H	H	L	M			
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H	M	H	L	M	L		M
	CO4	H	M		H	H		M			L	L	
	CO5	H	M	M	H	H	H	H		M	L	L	M
	CO6	H			H	H		M	M			L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Sterilization techniques.
2. Plant tissue culture techniques.
3. Preparation of culture medium
4. Callus induction in *Daucuscarota.*
5. Nodal bud culture.
6. Micropropagation of rose.
7. Rooting and hardening of regenerated shoots.
8. Isolation and purification of protoplast from *Aloe vera*leaf mesophyll cells.
9. Determination of protoplast viability using Evan's blue staining.
10. Protoplast fusion using PEG.
11. Preparation of synthetic seeds.
12. Isolation of Rhizobium from ground nut nodules.
13. Preparation of Rhizobialbiofertilizer.

14. Aseptic techniques for animal cell culture.
15. Establishment of a primary culture.
16. Resuscitation of frozen cell lines.
17. Subculture of adherent cell lines.

BBT602	ANIMAL BIOTECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Molecular biology, Genetic engineering, Microbiology, Immunology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biological mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of animal cells and culture
CO2	to apply the techniques for animal cell culture and its types
CO3	to comprehend genetics system
CO4	to know the large scale of cell cultures in a bioreactor
CO5	To know about the immune system
CO6	to get a basic knowledge of the applications of animal cell in biological systems and in relevant industries

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		H			L	L	
	CO2	H	M	M	H	H		M		M	L		M
	CO3	H			H	H	M	H	H			L	M
	CO4	H	M		H			M			L		
	CO5	H	M	M	H	H		M	M	M	L		M
	CO6	H			H	H		M				L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION **9**

History of animal cell and organ culture-requirements for animal cell and organ culture-characteristics of animal growth in culture-substrates for cell culture and its treatment-culture media-natural and synthetic media- sterilization of glassware, equipment and culture media.

UNIT II ANIMAL CELL CULTURE 9

Equipment required for animal cell culture-isolation of animal material- disaggregation of tissue by physical and enzymatic methods- establishment of cell culture-evolution of cell lines-primary and secondary cell culture-types of cell lines-factors affecting subculture in vitro.

UNIT III SUSPENSION CULTURE 9

Cultivation of animal cells in bioreactor-Suspension cultures-methods of scaling up of cell culture-roller bottle-spinner culture-immobilized cell culture-insect cell culture-somatic and organ cell culture- organ culture on plasma clots, agar and liquid medium-whole embryo culture-production of commercially valuable products obtained from animal and insect cell culture-hybridoma technology.

UNIT IV MANIPULATION OF REPRODUCTION 9

Manipulation of reproduction in animals-artificial insemination-semen collection and storage-ovulation control-embryo transfer-multiple ovulation and embryo transfer-embryo splitting and sexing-in vitro fertilization-nuclear transplantation-problems related to test tube babies-infertility in humans.

UNIT V TRANGENICS 9

Techniques of gene transfer in animals-transgenic animals- transgenic sheep and fish-knockout mice-animal bioreactor and molecular farming-diagnosis, elimination and breeding strategies of genetic diseases-PCR based markers-xenotransplantation-mapping of human genome-bioethics in animal genetic engineering.

TEXT BOOK

1. R.C. Dubey, 2005, "A textbook of Biotechnology", 3rd ed.

REFERENCE BOOK

1. Stewart Sell, 2004, "Stem Cells Hand Book" Humana Press.
2. John R.W. Masters, 2000, "Animal Cell culture a practical approach" Oxford University Press, 3rd ed.
3. YoshitoIkada, 2006, "Tissue engineering fundamentals and applications" Academic Press, 3rd ed.
4. John P. Fisher et al, 2007, "Tissue engineering" CRC Press.
5. Nigel Jenkins,2007, "Animal Cell Biotechnology" Hamana press, 2nd ed.
6. P. Ramadass. 2008 "Animal Biotechnology", MJP Pub.
7. Weblink: nptel

BBT605	ENZYME ENGINEERING AND TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biochemistry, Unit operation, Chemical reaction engg.				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES To provide a knowledge about enzymes and its kinetics													
COURSE OUTCOMES (COs)													
CO1	to understand the applications of enzymes in various fields												
CO2	to know about enzyme inhibition												
CO3	to know about kinetics of enzyme												
CO4	to know about immobilization and its applications												
CO5	to get knowledge about transport in cell												
CO6	to get ideas about various bioreactors and its uses												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	L	M	L	L	M
	CO2	H	M	M	H	H						L	M
	CO3	H	M		H	H		M	H	H	L		
	CO4	H	L		H			M			L	L	M
	CO5	H	M	M	H	H					L		M
	CO6	H			H	H	L	M	M	L		L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
4	Approval	37th Meeting of Academic Council, May 2015							

UNITI INTRODUCTION AND INDUSTRIAL APPLICATIONS 9

Definition and scope of biochemical processes - application of biochemical process in Pharma, food and other industries - comparison of chemical and biochemical processes - development and scope of biochemical engineering.

UNITII ENZYME KINETICS 9

Nature and function of Enzymes - Co - Enzymes and cofactor - classification of Enzyme - Practical application of Enzyme in biochemical processes of industrial importance - mechanism of enzymatic reaction –Michaelis-Menten Kinetics - Enzyme inhibition – kinetics of competitive and non-competitive inhibition-factors affecting the reaction rates - Immobilization Of Enzymes - Characteristics and applications.

UNIT-III MICROBIAL KINECTICS AND IMMOBILIZATION 9

Typical growth characteristics of microbial cells: Phase of growth curve, factors affecting growth- Monod Model - Immobilization of cells and characteristics - applications.

UNIT-IV TRANSPORT IN MICROBIAL SYSTEMS 9

Transport mechanism- gas liquid mass transfer in cellular system- design parameters affecting O_2 transfer- Measurement of K_La- factors affecting K_La- - Correlation of mass transfer co-efficient- Agitation and Aeration in fermentor- heat transfer- Power consumption using π theorem- sterilization: batch & Continuous.

UNIT-V BIOREACTORS 9

Classification- Stirred tank reactor, Bubble column- Air lift rector- Packed bed- fluidized bed- Trickle bed reactor- Industrially important reactor: Photo bio reactor, membrane bio reactor. Comparison of industrially important bioreactor

TEXT BOOKS

1. Manjula, 2006, "Bio and Enzyme Engineering", III Ed.

REFERENCE BOOK

1. J.B.Bailey and D.F. Ollis, 2005, "Biochemical Engineering Fundamentals" McGraw Hill, New York.
2. Dr.Mansi El Mans, 2006 "Fermentation microbiology and biotechnology" IV Ed,
3. Weblink: nptel

BBT607	**ENVIRONMENTAL BIOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biochemistry, Microbiology, Environmental Studies				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide basic knowledge about environmental issues related to bioprocess and its remedial measures

COURSE OUTCOMES (COs)

CO1	to understand the microbiological concepts in air
CO2	to know about various bioremediation techniques
CO3	to know about biosafety
CO4	to know about microbiology of water
CO5	to get idea about microbiology of soil
CO6	to know about IPR

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M	H	H		L	L	L	M
	CO2	H	M	M	H	H	H	M	H				M
	CO3	H	M		H		H	H			L	L	
	CO4	H	M		H	H	H	M			L		M
	CO5	H	M	M	H	H	H	M	M	M	L	L	
	CO6	H			H	H	H	M				L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I MICROBIOLOGY OF AIR AND WATER 9

Microbial Contamination of air-Enumeration of bacteria in air-Air Sampling devices-Air Sanitation and purification methods-Determination of Water quality-Bacteriological examination of water-indicator organisms-Water borne pathogens

UNIT II MICROBIOLOGY OF SOIL 9

Microbial flora of soil, Growth, Ecological adaptation, Interaction among soil microorganisms-Microorganisms involved in nitrogen fixation, Positive and negative role of microbes.

UNIT III DETOXIFICATION 9

Detoxification of Hazardous chemicals-Biocatalyst for pesticide Detoxification- Bioremediation: Bioremediation of Persistent chemicals-Improving catabolic processes, Biosorption of Heavy metals-Bioremediation of oil spills, Bio deterioration of paper, Textile, sugar distilleries, diary industries.

UNIT IV BIOWASTE UTILIZATION 9

Biotechnology for biowaste conversion in to bioresources-Single cell protein, Mushroom, Algal growth for fisheries, and Aqua culture- Industrial waste recycling -Waste fueled furnaces.

UNIT V BIOSAFETY AND IPR 9

Intellectual Property, Rights in bioremediation, Biosafety-Microbiology. Medical Laboratory-Medical waste- Bioharzardous waste-Sharps-Pathological waste-Rules and Regulations-Biosafety protocol

TEXT BOOK

1. Bruce. E.Rittaman and Perry. L. Mc Carty, 2004, "Environmental Biotechnology-Principles and applications" McGraw Hill.
2. N. Ahmed, F.M. Quershi and D. Y.Khan, 2001, "Industrial Environmental Biotechnology" Horizon press.

REFERENCE BOOKS

1. W.D. Grand, P.E. Long Blakies, "Environmental Microbiology", Glasgow London.
2. T. Meenambal, 2009, "Environmental Science and Engineering".
3. Weblink: nptel

BSS601	VALUE EDUCATION AND PROFESSIONAL ETHICS	L	T	P	C

	Total Contact Hours - 45	3	0	0	3
	Prerequisite – English & Professional Courses				
	Course Designed by – Dept. of Management Studies				

OBJECTIVES

- To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
- To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES (COs)

CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their curing
CO4	To learn more of Engineer as Responsible Experimenter.
CO5	To learn more of Risk and Safety assessment with case studies.
CO6	To learn more of Responsibilities and Rights as Professional and facing Global Challenges

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES 9

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe- Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.

UNIT III MIND CULTURE & TENDING PERSONAL HEALTH 9

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelizing the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV: ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS'SRESPONSIBILITIES FOR SAFETY 9

Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Challenger, case study-Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies

UNIT V: ENGINEERS'S RESPONSIBILITIES FOR RIGHTS AND GLOBAL ISSUES 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership

TEXT BOOKS

1. Value Education for Health, Happiness and Harmony, the World Community Service, Centre Vethathiri Publications (Unit 1 – III).
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata Mcgraw Hill, Newyork 2005 (Units IV & V)

REFERENCE

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
3. R S Nagaarazan, Textbook On Professional Ethics And Human Values, New Age International Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004 (Units IV-V)

BBT6L1	BIOPROCESS ENGINEERING LAB 1	L	T	P	C
	Total Contact Hours - 45	0	0	3	2

	Prerequisite – Bioprocess Engg., Unit Operation
	Course Designed by – Dept. of Industrial Biotechnology

OBJECTIVES: To provide basic knowledge about bioprocessing

COURSE OUTCOMES (COs)

CO1	to get knowledge on biomass
CO2	to know about enzyme kinetics
CO3	to understand about immobilization of enzyme
CO4	to get idea about mass transfer
CO5	to know about death kinetics
CO6	to know about product optimization

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H	H	M		M		H	L		M
	CO2	H	M	M	H	H			M			L	
	CO3	H	M	M	H			M			L	L	M
	CO4	H	M	H	H	H			H	M		L	M
	CO5	H	M	M		H	L	M			L	L	
	CO6	H		H	H	H		M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS

1. Culturing of different types of microorganism
2. Estimation of biomass production.
3. Enzyme kinetics.
4. Effect of temperature on enzyme activity.
5. Effect of pH on enzyme activity.
6. Effect of substrate concentration on growth of *E.coli.*
7. Immobilization of enzyme.
8. Estimation of k_La by sulphite oxidation method.
9. Thermal death kinetics of yeast.
10. Thermal death kinetics of bacteria.

BBT6L2	ENVIRONMENTAL BIOTECHNOLOGY LAB	L	T	P	C

	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Biochemistry, Microbiology, Environmental Biotechnology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide knowledge about environmental science and technology

COURSE OUTCOMES (COs)

CO1	to know about analysis of water
CO2	to understand about microbial examination of effluent
CO3	to get basic idea about adsorption of dye
CO4	to know about microbial remediation
CO5	to get basic idea about bioremediation
CO6	to know about analysis of soil

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M	M		M	H		L	
	CO2	H	M	M	H	H		M			L	L	
	CO3	H	M		H		M	M					M
	CO4	H	M		H	H			L	M		L	M
	CO5	H	M	M	H	H	M	M			L		M
	CO6	H			H	H				L	L	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Estimation of pH
2. Analysis of Alkalinity
3. Estimation of Hardness
4. Analysis of Chloride
5. Analysis of Total Dissolved Solids
6. Estimation of Fluoride
7. Analysis of Iron
8. Analysis of Nitrite
9. Analysis of Nitrate
10. Analysis of Phosphate
11. Analysis of Residual Chlorine
12. Microbiological Examination using Leather Effluents
13. Adsorption of Dye using Charcoal
14. Microbial Degradation of Dye
15. Reduction of Sulphate by biological method
16. Bioremediation of Hexavalent chromium reduction

BBT6L3	IMMUNOTECHNOLOGY LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Immunology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biological defense mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of immune system
CO2	to apply the techniques for antigen and antibody reaction
CO3	to give the mechanism of immune response against antigens
CO4	to know the natural barrier against pathogens
CO5	to get a basic knowledge of the applications of immunology in transplantation
CO6	to know about immune electrophoretic techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	M	M		L
	CO2	H	M	M		H		H				L	
	CO3	H			H			H	M	H			M
	CO4	H	M					M				L	
	CO5	H	M	M	H	H	H	H	L		L		M
	CO6	H			H	H		M		H	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg [illegible]	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. SDS- Slab gel electrophoresis of immunoglobulins
2. Western blotting
3. Immunoelectrophoresis
4. Countercurrent Electrophoresis
5. Rocket Immunoelectrophoresis
6. Single radial immunodiffusion
7. Double immunodiffusion
8. Dot- ELISA
9. DEAE cellulose chromatography for IgG.
10. Affinity chromatography for antiserum purification.

BBT6P1	MINI PROJECT	L	T	P	C
	Total Contact Hours -60	0	0	4	2
	Prerequisite – Biochemistry, Microbiology, Bioprocess, Plant and Animal Biotechnology				
	Course Designed by– Dept. of Industrial Biotechnology				

OBJECTIVES: To enable students to do independent research

COURSE OUTCOMES (COs)

- It is a two credit course offered in the VI Semester
- Each student will be allocated a guide and a research topic at the end of the V semester. This will help them to collect sufficient literature during their vacation. A guide will have a maximum of four students
- There are 4 hours allocated per week for the students to do research. This will be considered for the award of internal marks.
- There will be three reviews to assess the progress of their research
- The final review will be on the day of the external examination in the presence of the an external and internal examiner. The student will be judged based on the presentation and how he or she defends the selected topic.

BBT701	RESEARCH METHODOLOGY AND INSTRUMENTATION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biochemistry, Instrumental method of analysis, Downstream processing				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide basic knowledge about various instrumentation techniques and data documentation

COURSE OUTCOMES (COs)

CO1	to understand the biochemical analysis
CO2	to know about spectroscopic and microscopic techniques
CO3	to know about the separation techniques
CO4	to get ideas about ethical issues related to research
CO5	to know about data documentation
CO6	To prepare research articles

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		H	H	H	M	M	M
	CO2	H	M	M	H	H		H			L	L	
	CO3	H	M	H	H	H		M	H		M		M
	CO4	H	M	H	H	H	H	H		M		M	H

	CO5	H	M	M	H	H		M	H		L	L	M
	CO6	H	H	H	H	H		H		M	L		
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term paper Seminar/ Internship (PR)	
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I BASIC PRINCIPLES FOR BIOCHEMICAL ANALYSIS 9

Introduction – preparation of organ and tissue samples for analysis – cell disruption methods – physiological solutions: buffers and growth media for plants, animals and microbes – Medium standardization - cell sorting, isolation and enumeration techniques – cryopreservation – elucidating metabolic pathways by tracer studies.

UNIT II SPECTROSCOPIC AND MICROSCOPY TECHNIQUES 9

Introduction – UV – visible spectroscopy – NMR spectroscopy – IR and Raman spectroscopy – atomic spectroscopy - Introduction to microscopy – Election microscopy –ultramicrotome- phase contrast microscopy – Fluorescent and confocal microscopy.

UNIT III SEPARATION TECHNIQUES 9

Introduction to chromatography and electrophoresis – gel filtration – ion exchange – affinity – GC – HPLC - partition chromatography – electrophoresis of proteins and nucleic acids – immune precipitation techniques – ELISA.

UNIT IV ETHICAL ISSUES IN BIOTECHNOLOGY 9

Legal and socio economic impacts of biotech research – bio safety regulation – r-DNA guidelines- issues involved in experimenting with animals – Experimental protocol approvals – contaminant levels and environmental effects- impact of GM organisms and GM foods – IPR and patents.

UNIT V DATA ANALYSIS AND DOCUMENTATION 9

Sampling concepts for statistical analysis – Mean, median, standard deviation, standard error – ANNOVA – Guidelines for thesis writing: literature collection methods – writing of abstract, introduction and review of literature – results, discussion and summary – guidelines to publish articles in journals.

TEXT BOOKS

1. Keith Wilson and John Walker,2004, Practical biochemistry, Principles and techniques – Cambridge publication
2. N. Gurumani, 2006, Research methodology for biological sciences, MJP publishers.

REFERENCE BOOKS

1. P. Ramadass, 2009, Research and writing: Across the disciplines, MJP publishers.

BBT703	DOWNSTREAM PROCESSING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Unit Operation, Bioprocess engineering				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide basic knowledge about various separation techniques in bioprocesses

COURSE OUTCOMES (COs)

CO1	to understand the unit operations involved in downstream
CO2	to know about various separation processes
CO3	to know about the product recovery and purification techniques
CO4	to get basic idea about fractionation
CO5	to know about product polishing technique
CO6	to know the various industrial product purification

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M				L	M
	CO2	H	M	M	H	H			H	M	L	L	
	CO3	H	M		H	H		H				L	M
	CO4	H	M		H			M	L		L	L	M
	CO5	H	M	M	H	H		H		M	L	L	
	CO6	H			H	H	L	M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ROLE OF DOWNSTREAM PROCESSING IN BIOTECHNOLOGY 9

Role and Importance of downstream processing in biotechnological processes- Problems and requirements of bioproduct purification-Economics of downstream processing in Biotechnology, cost - cutting strategies, characteristics of biological mixtures, process design criteria for various classes of bioproducts (high volume, low value products and lowvolume, high value products), physico- chemical basis of bioseparation processes

UNIT II PRIMARY SEPARATION AND RECOVERY PROCESSES 9

Cell distribution methods for intracellular products, removal of insolubles, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods

UNIT III ENRICHMENT OPERATIONS 9

Membrane separations (micro and ultrafiltration theory, and configuration of membrane separation equipment) applications, precipitation methods - extractive separations, aqueous two phase extraction, supercritical extraction- *insitu* product removal, integrated bioprocessing.

UNIT IV PRODUCT RESOLUTION/FRACTIONATION 9

Adsorptive chromatographic separation processes, electrophoretic techniques.

UNIT V PRODUCT POLISHING 9

Gel Permeation Chromatography, dialysis, Crystallization

TEXT BOOK

1. SivaShankar , 2004, "BioSeparation" III Ed,

REFERENCES

1. Wankat P.C, 2003, "Rare Controlled Separations", Elsevier,.
2. Better PA and Cussier E, 2002,"Bioseparations", Volley,
3. Weblink: nptel

BBT705	**BIOPROCESS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Chemical reaction engg., Unit operation, Animal biotechnology, Plant biotechnology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES:

To provide a knowledge about various bioprocesses and the designing of reactor

COURSE OUTCOMES (COs)

CO1	to know basic concepts in bioprocess engineering
CO2	to know different types of plant and animal cell bioreactors
CO3	to understand basic concepts in transport phenomena in bioprocessing
CO4	to get knowledge about bioreactor design
CO5	to know about modern biotechnological processes
CO6	to know about modeling and simulation of bioprocess technology

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		H	H		L	L	
	CO2	H	M	M	H	H		M		M	L	L	
	CO3	H	M		H	H		M				L	M

	CO4	H	M		H		L				M	L	M
	CO5	H	M	M	H	H		M	M		L		
	CO6	H			H	H	M	M		L	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I DESIGN AND ANALYSIS OF BIOPROCESSES 9

On-line data analysis for measurement of important physico-chemical and biochemical parameters; Methods of on-line and off-line biomass estimation; microbial calorimetre; Flow injection analysis for measurement of substrates- Product and other metabolites: State and parameter estimation techniques for biochemical processes-Biosensor

UNIT II RANSPORT PHENOMENA IN BIOPROCESS SYSTEM 9

Role of diffusion in bioprocess- Film theory- Oxygen uptake in cell culture, factors affecting cellular Oxygen demand, Oxygen transfer from gas bubble to cell, Measuring DO concentration, measurement of KLa .

UNIT III BIOREACTOR 9

Basic design consideration for a bioreactor- Batch Bioreactor- Fluidized bed reactor- Air lift bioreactor- Trickle bed bioreactor- Hollow fibre reactor- and wave bioreactor (Disposable bioreactor)

UNIT IV MODERN BIOTECHNOLOGICAL PROCESSES 9

Recombinant cell culture processes, guidelines for choosing host-vector systems, plasmid stability in recombinant cell culture, limits to over expression, Modelling of recombinant bacterial cultures; Bioreactor strategies for maximizing product formation; Bioprocess design considerations for plant and animal cell cultures.

UNITV MODELLING AND SIMULATION OF BIOPROCESSES 9

Study of Structured models for analysis of various bioprocess; Computer based data acquisition, Monitoring and control- Lab view software, MATLAB-SIMULINK

TEXT BOOK

1. Shuler and Kargi, 2004, "Bioprocess Engineering Fundamentals", McGraw Hill 2nd Ed.

REFERENCES

1. Sameer A. Zodgkar,2008, “Bioprocess” ICFAI University Press, 1st.
2. P.T. Kalaichelvan and I. Arul Pandi. 2007 “Bioprocess technology”. MJP Pub.
3. FunshangYabgJuming Tang, 2002, “Advances in Bioprocess Engineering” World scientific publishing company 2nd.

4. Syed Tanveer Ahmed Inamdar, 2007, "Biochemical Engg principles & concepts" Prentice Hall of India,2nd Edition.
5. Weblink: nptel

BBT7L1	BIOPROCESS ENGINEERING LAB II	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Microbiology, Bioprocess Engineering, Biochemistry				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide knowledge about production of bioproducts

COURSE OUTCOMES (COs)

CO1	to know about media formulation
CO2	to know about media sterilization
CO3	to understand about Solid State Fermentation
CO4	to get basic idea about production of natural wine and biofuel
CO5	to get basic idea about production of soap
CO6	to get basic idea about production of fertilizer

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M		M				M		L	M
	CO2	H	M	M	H	H		M			L	L	
	CO3	H	M		H			M	M	L		L	M
	CO4	H	M			H	M				L		M
	CO5	H	M	M	H	H		M		L	L	L	
	CO6	H			H	H	M	M	L		L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Plate assay
2. Media optimization by Plackett-Burmann method
3. Solid state fermentation.
4. Production of wine
5. Estimation of alcohol concentration in wine.
6. Estimation of acid concentration in wine.
7. Production of soap and analyze its properties.

8. Production of biodiesel and analyze its properties.
9. Activity of Various Natural Substances on the Growth of *Malassezia furfur*
10. Production of biofertilizer.

BBT7L2	**DOWNSTREAM PROCESSING LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Downstream Processing, Microbiology, Unit Operation				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide knowledge about purification of bioproducts

COURSE OUTCOMES (COs)

CO1	to know about precipitation technique
CO2	to understand about flocculation and settling
CO3	to get basic idea about chromatographic techniques
CO4	to get basic idea cell disruption
CO5	to know about extraction
CO6	to know about crystallization

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M					H			L	M
	CO2	H	M	M	H	H		M		M	L		
	CO3	H	M		H	H		M			L		M
	CO4	H	M						M	L	L	L	
	CO5	H	M	M	H	H		M			L		M
	CO6	H			H	H		M				L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Isoelectric precipitation
2. Settling characteristics
3. Flocculation (Jar Test)
4. Solids Recovery by Centrifugation
5. Paper chromatography
6. Thin Layer Chromatography
7. Ion –Exchange Chromatography
8. Affinity Chromatography
9. Gel Filtration

10. Desalting of Protein Sample by Gelfiltration
11. Sonication
12. Crystallization
13. Aqueous Two Phase Extraction Of Proteins
14. Enzyme Purification by Salt precipitation Method.

BBT7P1	TERM PAPER	L	T	P	C
	Total Contact Hours -60	**0**	**0**	**4**	**2**
	Prerequisite – Biochemistry, Microbiology, Bioprocess, Plant and Animal Biotechnology				
	Course Designed by– Dept. of Industrial Biotechnology				

OBJECTIVES

To enable students to do independent research

COURSE OUTCOMES (COs)

- It is a two credit course offered in the VII Semester
- Each student should register for the course
- Each student will be allocated a guide and a research topic at the end of the VI semester. This will help them to collect sufficient literature during their vacation. A guide will have a maximum of four students
- There are 4 hours allocated per week for the students to do research. This will be considered for the award of internal marks.
- There will be three reviews to assess the progress of their research
- The final review will be on the day of the external examination in the presence of an external and internal examiner. The student will be judged based on the presentation and how he or she defends the selected topic. The student also should publish a paper in a journal or in a conference proceeding

BBT8P1	PROJECT WORK	L	T	P	C
	Total Contact Hours -18 per week	0	0	18	9
	Prerequisite – Biochemistry, Microbiology, Bioprocess, Plant and Animal Biotechnology, Downstream process				
	Course Designed by– Dept. of Industrial Biotechnology				

OBJECTIVES: To enable students to do independent research

COURSE OUTCOMES (COs)

- It is a nine credit course offered in the VIII Semester
- Each student will be allocated a guide and a research topic at the end of the VII semester. This will help them to collect sufficient literature during their vacation. A guide will have a maximum of four students
- There are 18 hours allocated per week for the students to do research. This will be considered for the award of internal marks.
- There will be three reviews to assess the progress of their research
- The final review will be on the day of the external examination in the presence of an external and internal examiner. The student will be judged based on the presentation and how he or she defends the selected topic.

BBTE01	FOOD PROCESS TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioprocess technology, Heat and mass transfer				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide basic technologies involved in food processing

COURSE OUTCOMES (COs)

CO1	To know about preservation techniques
CO2	to understand basic concepts in sterilization of food products
CO3	to know about various dryers
CO4	to know about the mixing equipment for various products
CO5	to know about various preservation techniques for food products
CO6	to understand the microbiological aspects in food process

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M		L	L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M	L	M	L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M	M	H	L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
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4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PHYSICAL TREATMETN OF FOOD 9

Thermal, electrical and rheological properties- Heat processing- Methods of applying heat to food - sterilization - Thermo bacteriology- dehydration and drying - free moisture - equilibrium moisture content- water activity- classification of dryers- tray, and freeze dryers, osmotic dehydration - foam mat drying- extrusion coking.

UNIT II BLENDING METHODS 9

Mixing of solids, Pastes and liquids - Characteristics of mixtures-Blending -emulsification- equipments - liquid, pastes, and plastic masses - dry powders - criteria of mixer effectiveness- mixing index

UNIT III PRESERVATION OF FOOD 9

Concentration - freeze concentration - freezing and storage of frozen products - low temperature preservation - irradiation of food products - microwave heating - dielectric heating of foods.

UNIT IV DAIRY FOODS 9

Physics and chemical properties of milk and their effect on design - heaters - coolers -heat exchange equipments - storage tanks - can washers - pasteurization - principles and methods - equipments - LTLT - HTST - UHT pasteurization - CIP unit -Homogenization - Theory and working of homogenizers - bottle fillers and cappers -cream separation - principles - types of separator - classifiers - butter churns - cheese plant equipments - ice cream freezers - drying equipments - drum drier and spray drier -membrane concentration equipments.

UNIT V FOOD MICROBIOLOGY 9

Food microbiology: food spoilage, food borne diseases, infections, intoxifications, utilization of microorganisms in food industries, Nutraceuticals. Quality control, Case studies on biotechnology in the evaluation of food quality.

TEXT BOOKS

1. Lehninger and Beverlov, 2002, "Food Process Engineering". Reidal Publishing Co. Holland
2. Yin H.Hui, 2006, "Handbook of food science, technology and engineering" Wiley, New York, 2nd ed

REFERENCE BOOKS

1. Tucker & Woods, 1995, "Enzymes in food processing" Springer, 5th ed.
2. Hamm &Hammilton, 2000, "Edible oil processing" Academic Press 5th ed
3. Fellows, 2009, "Food processing technology" 21th ed
4. Heldman, 2007,"Hand book of food engineering" CRC Press 2nd ed
5. P.G. Smith, 2003, "Food Process Engineering" Academic Plenum Pub, New York 1st ed
6. Srilakshmi,2005, "Food Science" MJP Publiashers, 3rd ed
7. Weblink: nptel

BBTE02	CANCER BIOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biotechnology, Molecular biology, Genetic engineering				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biological mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of cancer cells and its constituents
CO2	to find the environmental factors related to cancer
CO3	to know the concept of carcinogenesis and carcinogenic agents
CO4	to know the cause, symptoms, diagnosis and treatment of cancer
CO5	to give a basic knowledge of the different types of cancer
CO6	To understand about basics of cancer therapy

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	H	M	M	H	M		M		H	L	L	M
	CO2	H	M	M	H	H		M	H				L
	CO3	H	M		H	H		M	M	M	L	L	
	CO4	H	M		H	H	L	M				L	H
	CO5	H	M	M	H	H		M	L	L	L		
	CO6	H			H	H	L	M				L	
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)				
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION 9

Fundamentals of Cancer Biology- Cell Cycle- regulation of cell cycle, modulation in cell cycle in cancer, Changes in signaling molecules- Effects on receptors, signal switches, Classification of stages of cancer- metasis, Metastatic cascade, common features of cancer cells, Tumor suppressor genes, Cancer genetics.

UNIT II CARCINOGENESIS 9

Principles of Carcinogenesis- Carcinogens- Targets of carcinogens, Chemical carcinogenesis, Physical carcinogenesis- X-ray radiation and radiation carcinogenesis, Viruses and Cancer, Diet and cancer

UNIT III MOLECULAR BIOLOGY OF CANCER 9

Molecular biology of cancer- Oncogenes, Identification of oncogenes, Retroviruses and oncogenes, growth factors and Growth factor receptors as oncogenes.

UNIT IV TYPES OF CANCER 9

Different sites and forms of cancer, Lung, Liver, Breast, Cervical, Blood, Prostrate, Ovarian cancers- Epidemology, causes, mutations, and features

UNIT V CANCER THERAPY 9

Cancer therapy- Cancer Immunology, Different forms of cancer therapy- Chemotherapy, radiation, Detection of cancers, advances in cancer detection and therapy, Gene therapy.

TEXT BOOKS:

1. Lewis J.Kleismith,2006, "Principles of Cancer Biology" Pearson Benjamin Cummings.
2. Raymond W. Ruddon,2007, "Cancer Biology" Oxford University Press, 4th.

REFERENCE BOOKS:

1. G.M. Cooper,2008, "Oncogenes" Jones &barlett Publisher, 1st.
2. 'Molecular Cell Biology' Darnell, Lodish& Baltimore, IV Ed,2004
3. An Introduction to cellular and Molecular Oncology- Oxford University Press, 2003
4. Genes VII and VIII – Benjamin Lewin, 2004
5. Weblink: nptel

BBTE03	BIOREACTOR DESIGN	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biotechnology, Fermentation Techniques, Chemical reaction engineering, Bioprocess engineering				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide knowledge about the designing of reactor

COURSE OUTCOMES (COs)

CO1	To understand the fundamentals transport phenomena
CO2	To know about various types of reactors
CO3	To know about instrumentation and control of reactors
CO4	To learn the process of modulation and simulation of fermentation process
CO5	To understand plant and animal cell reactors
CO6	To get the knowledge of bioreactors and its Industrial

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M		M	L	L	
	CO2	H	M	M	H	H		M	H				M
	CO3	H	M			H					L	L	
	CO4	H	M		H	H		M	H		L		M
	CO5	H	M	M	H	H		M		H	L	L	M
	CO6	H			H	H	L	M				L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BIOREACTOR DESIGN 9

Batch reactors; Continuous Stirred Tank Bioreactors (Chemostat); Enzyme Catalysis in Chemostat; Age Distribution Models; Fed Batch Reactors; Recycle Systems, Design of airlift bioreactors

UNIT II TRANSPORT PHENOMENA & GROWTH MODELS 9

Rheology; Gas-Liquid Mass Transfer- Measurement of transfer coefficients; Design of bubble columns; Three-phase flow, mixing, oxygen transfer: isobaric method, non-isobaric model, oxygen transfer in a three-phase flow-Phases of batch growth cycle; Monod Model; Models of Product Formation and Inhibition; Introduction to structured models

UNIT III BIOREACTOR INSTRUMENTATION AND CONTROL 9

Introduction, bioreactor sensor characteristics, temperature measurement and control, principles of dissolved oxygen measurement and control, principles of pH/redox measurement and control, detection and prevention of foam, determination of biomass, ion specific electrodes, biosensors.

UNIT IV FERMENTATION CONTROL 9

Introduction to control: control loop, analogue and digital control, control algorithm-PID control, time-proportional control. Physical control of fermentation

MODELING AND SIMULATION OF FERMENTATION PROCESSES

Modeling, digital simulation, digital simulation programming languages, ISIM(interactive simulation language)

UNIT V PLANT AND ANIMAL CELL BIOREACTORS 9

Introduction, plant cells: plant cell bioreactors, characteristics of plant cell suspensions, plant cell bioreactor requirements, plant cell bioreactor design, plant cell bioreactor operation, alternative cultures for plant cells. Animal cells: Animal cell bioreactors, animal cell bioreactor operation, animal cell bioreactor design

TEXT BOOKS

1. Scragg A.H.,2002, "Bioreactors in Biotechnology", Edited by, Ellis Horwood Limited, England
2. Bailey and Ollis, 2000, "Biochemical Engineering Fundamentals", McGraw Hill 3rd ed.

REFERENCE BOOKS

1. Stanbury PF,1984, "Principles of fermentation technology" SS Hall, 2nd.
2. Mansi El Mansi.2003 "Fermentation Microbiology & Biotechnology".IVEd.
3. Weblink: nptel

BBTE04	DIARY TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioprocess, Food process engineering				
	Course Designed by – Dept of Industrial Biotechnology				
OBJECTIVES To explore the different techniques involved in diary science					
COURSE OUTCOMES (COs)					

CO1	To study the process involved in the marketing of milk
CO2	To learn about the processing of butter and skim milk powder
CO3	To understand the steps involved in cheese making
CO4	To learn to prepare milk sweets
CO5	To explore the quality control methods involved
CO6	To understand about preservation techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M		H	L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M	H		L	L	M
	CO4	H	M		H	H		M		M	L	L	M
	CO5	H	M	M	H	H		M	M		L	L	M
	CO6	H			H	H		M		L	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Market milk – market milk industry in India – Collection, Transportation of milk- milk reception – Clarification- Chilling – Homogenization – Sterilization- Pasteurization – UHT processing of fluid milk – aseptic packaging – Special milk – Clean Milk Production – Grading of Milk.

UNIT II DAIRY PRODUCTS 9

Fat rich Dairy products – Cream, preparation, types, defects – Butter preparation, types, defects – Butter Spreads- Preparation of Ghee , defects in ghee- AGMARG standards- Frozen dairy products – Manufacture of Ice Cream: Ingredients and their role, types and defects, Judging and grading of Cream, Butter and Ice Cream. Concentrated and dried milk Products- Condensed milk – Evaporated milk – BIS standards –defects- Manufacture of milk powder- whole milk, skim milk powder- spray drying – whey powder- whey protein concentrates- biodiesel from whey.

UNIT III CHEESE AND FERMENTED PRODUCTS 9

Cheese and fermented products- Classification- preparation of cheddar, cottage, mozzarella and processed cheese- cheese spreads- ripening – accelerated ripening- action of rennet – microbial rennet – milk coagulating enzymes – defects in cheese, causes and control measures- fermented milk products – Manufacture of Dahi- yogurt- shrikhand- therapeutic effects of fermented milk products- functional foods- probiotics - prebiotic -symbiotic.

UNIT IV INDIGENOUS MILK PRODUCTS 9

Indigenous milk products and by products – Channa – Chana based products – preparation of Khoa and Khoa based products – peda- Gulabjamun – Rasagolla – preparation of paneer – kulfi – utilization of skim milk – butter milk – whey.

UNIT V QUALITY CONTROL AND QUALITY ASSURANCE 9

Introduction- Cleaning and Sanitation – Sterilization agent- Can Washing- Manual & Mechanical washing – Washing treatments – Cleaning in Place Programmes (CIP) – Packaging of milk & Milk Products – Function- Packaging Material – Filling system – Aseptic Packaging

TEXT BOOK:

1. Sukumar de, 2000, "Outlines of Dairy Technology" Oxford Univ press
2. Bhattacharya A and Rajan R P, 2002 "An over view on Yogurt, beverage and food world".

REFERENCE BOOKS:

1. Andrews,2004, "Biochemistry of Milk Products" Black rabbit books, 2nd ed.
2. Ananthakrishnan C P., and Padmanabhan " The technology of milk processing" Shrilakshmi publications

BBTE05	MEDICAL BIOTECHNOLOGY	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Immunology, physiology, animal biotechnology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biological systems and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of genetics and their relationship to hereditary disorders
CO2	to apply the concept of plant, animal and microbial systems in discovery of medicine
CO3	to comprehend genetics and the immune system
CO4	to know the cause, symptoms, diagnosis and treatment of common diseases
CO5	to know the cause, symptoms, diagnosis and treatment of common diseases
CO6	to apply the concept of plant, animal and microbial systems in discovery of medicine

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M		L	L	L	M
	CO4	H	M		H	H		M	L		L	L	M
	CO5	H	M	M	H	H	L	M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I HUMAN GENETICS 9

Genes and Chromosome- structure, function and inheritance- Repetitive DNA in human genome- Alu, LINE and SINE repeats- Congenital abnormalities, Clinical aspects of autosomal and sex chromosomal disorders. Gene therapy and its types

UNIT II HUMAN PHYSIOLOGY 9

Structure, types and functions of tissues and muscles-Biological functions and abnormalities of digestive system, circulatory system, excretory system and central nervous system

UNIT III HORMONES 9

Hormones- structure, classification, biosynthesis and circulation in blood- Synthesis transport and biological functions of pituitary hormones, thyroid hormones and pancreatic hormones

UNIT IV CLINICAL BIOCHEMISTRY 9

Blood sugar level in diabetes mellitus- Blood pressure and cholesterol level in heart attack- Clinical significance of diagnostic enzymology- Evaluation of renal, pancreatic, liver and intestinal function

UNIT V GERM LINE ENGINEERING 9

Characteristics and diagnostic applications ofstem cell culture, organ culture, embryo culture – Artificial blood- Genetic counseling-Artificial insemination, IVF and embryo transfer in humans- Egg and sperm Preservation banks

TEXT BOOKS

1. Lehninger Nelson &Cox., 2009 “Principles of Biochemistry”,5th edition
2. Chatterjee and Raneshinde2009 “Clinical Biochemistry”7th edition.

REFERENCES

1. Guyton,2010 “Medical physiology”, 12th edition
2. Devlin, 2005 “Biochemistry with clinical correlation”, 10th edition
3. Weblink: nptel

BBTE06	BIOPROCESS ECONOMICS AND PLANT DESIGN	L	T	P	C
	Total Contact Hours -45	3	0	0	3

	Prerequisite – Basic Biotechnology, Chemical Reaction Engineering, Bioreactors
	Course Designed by – Dept of Industrial Biotechnology
OBJECTIVES: To provide knowledge about process economics and plant design	
COURSE OUTCOMES (COs)	
CO1	To understand basic principles of process design
CO2	To know about marketing of products
CO3	To know about capital and fixed cost
CO4	To study the cost involved in human resources
CO5	To understand about the administration of a plant
CO6	To understand about the economics of a plant design

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	F	G	h	i	j	K	l
2	CO1	H	M	M	H	M		M			L		
	CO2	H	M	M	H	H		M		M		L	M
	CO3	H	M		H	H		M	M		L		
	CO4	H	M		H	H	L	M			L	L	M
	CO5	H	M	M	H	H		M				L	M
	CO6	H			H	H		M	L	M	L		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PROCESS DESIGN DEVELOPMENT 9

Technical feasibility survey, process development, flow diagrams, equipment design and specifications

UNIT II GENERAL DESIGN CONSIDERATION 9

Marketability of the product, availability of technology, raw materials, equipment, human resources, land and utilities, site characteristics, waste disposal, government, regulations and other legal restrictions, community factors and other factors affecting investment and production cost.

UNIT III COST ESTIMATION 9

Capital investment-fixed capital investments including land, building, equipment and utilities, installation cost(including equipment, instrumentation, piping, electrical installation and other utilities), working capital investment.

UNIT IV COST ESTIMATION 9

Manufacturing costs-Direct Production cost(including raw materials, human resources, maintenance and repair, operating supplies, power and other utilities, royalties etc) fixed charges (including depreciation, taxes insurance, rental cost etc).,

UNIT V LIABILITIES 9

Plant overheads-Administration, safety and auxiliary services, payroll overheads, ware house and storage facilities etc. Profitability Analysis-return on original investment, interest rate of return, accounting for uncertainty and variations and future developments- Optimization techniques-Linear and Dynamic programming, Optimization strategies

TEXT BOOK:

1. Peters and Timmerhaus, "Plant design and Economics for Chemical Engineers ",McGraw Hill 4th Edition, 2002.

REFERENCES:

1. Rudd and Watson, "Strategy of Process Engineering ", Wiley, 2003.

BBTE07	**FOOD SAFETY AND QUALITY CONTROL**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Food process engineering, Microbiology, Bioprocess Engineering, Biochemistry				
	Course Designed by – Dept. of Industrial Biotechnology				
OBJECTIVES: To know about the safety regulations of food industries					
COURSE OUTCOMES (COs)					
CO1	To study the history of food safety regulations				
CO2	to know about food adulteration				
CO3	to understand about food management practices				
CO4	to get basic idea about food hygiene				
CO5	to get basic idea about microbial quality control				
CO6	to get basic idea about food safety standards				

UNIT I FOOD SAFETY REGULATIONS 9

History of food regulations in India- Legislations- Prevention of Food Adulteration act 1954, Food product order (1955), Solvent Extracted Oil, De-oiled Meal and Edible Flour (Control) Order, 1967, Meat Food Products Order (1973),Edible Oils Packaging, 1998, Edible Oils Packaging, 1998, Vegetable Oil Products Order, 1998, Milk & Milk Product Amendment Regulations – 2009.

UNIT II FOOD SAFETY MANAGEMENT 9

Introduction to concepts of food quality, food safety, food quality assurance and food quality management; objectives, importance and functions of quality control, Current challenges to food safety Food adulteration, nature of adulterants, methods of evaluation of food adulterants and toxic constituents.

UNIT III FOOD QUALITY MANAGEMENT 9

Principles of food quality assurance, total quality management (TQM)–good manufacturing/management practices, good hygienic practices, good lab practices, general awareness and role of management practices in quality control Food safety management, applications of HACCP in food safety, concept of food traceability for food safety,

UNIT IV MICROBIAL CONTAMINATION 9

Microbial quality control: determination of microorganisms in foods by cultural, microscopic, physical, chemical methods. Statistical quality control in food industry Food safety and Standards Act 2006: salient provision and prospects

UNIT V FOOD SAFETY STANDARDS 9

Role of national and international regulatory agencies, Bureau of Indian Standards (BIS), AGMARK, Food Safety and Standards Authority of India (FSSAI), Introduction to WTO agreements: SPS and TBT agreements, Codex alimentarious commission, USFDA, International organization for standards (ISO) and its standards for food quality and safety (ISO 9000 series, ISO 22000, ISO 15161, ISO 14000)

TEXT BOOKS:

1. V. K. Kaushik (1999),Nutrition And Food Safety, Neha Publishers
2. Early. R. (1995): Guide to Quality Management Systems for the Food Industry, Blackie, Academic and professional, London.

REFERENCE BOOKS:

1. Andre, Gordan (2015), Food Safety and Quality Systems in Developing Countries, Elsevier
2. YasmineMotarjemi(2013), Food Safety Management, 1st Edition, Elsevier

BBTE08	**STEM CELLS AND TISSUE ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Animal Biotechnology, G3enetic Engineering, Molecular Biology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide a basic understanding of stem cells and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of stem cells and its types
CO2	to apply the techniques for preservation of stem cells
CO3	to give the information about embryonic stem cell research
CO4	to know the role of stem cells in medicine
CO5	to get a basic knowledge of the applications of stem cells in gene therapy
CO6	to know about formation of new organs from stem cells

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	L		L		M
	CO2	H	M	M	H	H		M		H	L	L	M
	CO3	H	M		H	H		M				L	M
	CO4	H	M		H	H			H		L	L	
	CO5	H	M	M	H	H		M		M		L	M
	CO6	H			H	H		M			L		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I ORIGIN AND CHARACTERISTICS OF HUMAN STEM CELLS 9

Origin and characteristics of human stem cell, plasticity of human somatic stem cells research, Novel stem cell based therapies, Scientific and technical obstacles to overcome before realizing the potential clinical uses of novel human stem cell based therapy, Cord blood,-Stem cell marker.

UNIT II HUMAN EMBRYONIC STEM CELL RESEARCH 9

Possible sources for human embryonic stem cell, growing human ESC in laboratory, Current advantages and limitations of hESC and human somatic cells-Examining the need for new hES cell lines, Developments regarding establishment of human stem cell banks and registries.

UNIT III ISOLATION AND IDENTIFICATION OF STEM CELLS 9

Preparation of complete human neuroculture, Culturing and subculturing human neurospheres, Differentiation of cells from human, neurospheres into neurons, astrocytes and oligodendrocytes; Immunolabelling procedures

UNIT IV GENE THERAPY 9

Possibilities to overcome immuno-rejection responses in stem cell therapy, Haematopoietic stem cell transplantation - A new therapy for autoimmune disease, Prenatal diagnosis of genetic abnormalities using fetal CD34+ stem cells, Stem cells in treatment for major diseases and reparative medicine, ESC a promising tool for cell replacement therapy, germ line therapy.

UNIT V TISSUE ENGINEERING 9

Basic principles and consideration - Cell type and source, Metabolic requirements of cells, Reconstruction of connective tissues, Reconstruction of epithelial or endothelial surfaces - cells embedded in extracellular matrix material, Culture on a single surface and sandwich configuration, Bioreactor design on tissue engineering - Hollow fiber systems, Microcarrier based systems-Tissue engineering of the liver.

TEXT BOOK:

1. R.C.Dubey, 2004, "Text book of Biotechnology" 3rd Ed.

REFERENCE BOOK:

1. SudhaGangal , 2002, "Principles and Practice of Animal tissue culture", IV Ed
2. P. Ramadass , 2008, " Animal Biotechnology" MJP pub.
3. Weblink: nptel

BBTE09	BIOSENSOR TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biochemistry, Basic biotechnology, Bioprocess Engineering				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide basic knowledge about the biosensors

COURSE OUTCOMES (COs)

CO1	to understand basic principles of biosensor
CO2	to know about various types of biosensor
CO3	to know about applications of biosensors in various fields
CO4	to get some knowledge about transducers in biosensors
CO5	to learn about the applications of transducers in biosensors
CO6	To get knowledge about

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M			L	L	
	CO2	H	M	M	H				H	H		L	M
	CO3	H	M		H	H		M		H	L		M
	CO4	H	M			H		M			L	L	
	CO5	H	M	M	H	H		M	H	M	L		
	CO6	H			H	H						L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
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4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Biosensor – principle, construction, components, Advantages and limitations; ISFET, ENFET, ISE

UNIT II TYPES 9

Various biological materials used for biosensor construction - Microbial biosensors, Enzyme biosensor, Tissue based biosensor, Affinity biosensor

UNITIII TRANSDUCERS IN BIOSENSOR-I 9

Potentiometric, Amperometric biosensors - Principle, constructions, and applications- Generations of biosensor Technology

UNIT IV TRANSDUCERS IN BIOSENSOR-II 9

Calorimetric, Optical, Piezo – electric biosensors - Principle, constructions, and applications

UNIT V APPLICATIONS 9

Online/Offline monitoring in bioprocess; Applications in clinical chemistry, medicine, health care, veterinary, agriculture, food and environmental monitoring.

TEXT BOOK

1. Alice Cunningham, 2000, "Introduction to BioanalyticalSensors",John Wiley& Sons,.
2. Jiri Janata, 2002, "Principles of Chemical Sensors" Plenum Press.

REFERENCE BOOKS

1. F. Schellr, F. Schubert, J. Fedrowitz, BirkhauserVerlag ,1995 "Frontiers in Biosensors"
2. F. Ligler, C. Rowe Taitt, 2002 "Optical Biosensors. Present & Future" Elsevier,
3. Brian Eggins, 2002 "Chemical Sensors and Biosensors" John Wiley & Sons,
4. Graham Ramsay,1998, 'Commercial Biosensors'-, John Wiley& Sons.
5. Weblink: nptel

BBTE10	**PROTEOGENOMICS AND BIOINFORMATICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioorganic chemistry, Basic Biotechnology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of genomics and proteomics using software and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the classification of biological databases and its role in research
CO2	to apply the concept of genomics of different organism, gene expression and mapping situations
CO3	to know the tools for gene identification and prediction
CO4	to know the structural elucidation and prediction of proteins
CO5	to get a basic knowledge of techniques related to proteomics
CO6	To know about bioinformatics tools

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	H	M	M	H	M		M		L	L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M	M		L	L	M
	CO4	H	M		H	H		M		M	L	L	M
	CO5	H	M	M	H	H		M	L		L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
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4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BIO INFORMATICS 9

Introduction to bioinformatics – Databases, Classification – Biological Databases, and application – Data mining and Applications – Sequence Database search – FASTA – BLAST.

UNIT II GENOMICS 9

Genome – Organization of Eukaryotic genome – Mitochondrion and chloroplast genome Mapping strategies – Genetic mapping and physical mapping – Genome mapping – Human genome project – Gene expression – Microarrays

UNIT III SEQUENCE TECHNOLOGIES 9

Alignment of multiple sequences – Methods and applications – Phylogenetic analysis – Tools for sequence alignment. Gene identification Methods and applications – Tools for gene prediction – Methods and applications

UNIT IV PROTEOMICS 9

Lifecycle of protein – Classification and structure visualization techniques – Protein databases – Prediction of primary and secondary structure – Prediction of 2D and 3D structure

UNIT V TOOLS OF PROTEOMICS 9

Protein extraction – Separation and digestion techniques – Mass spectrometry –MALDITOF – Peptide mass finger printing – Peptide sequence analysis – SALSA and TMS

TEXT BOOK

1. S.C. Rastogi, 2007, "Bioinformatics methods and applications ", Prentice – Hall of India Publication

REFERENCE BOOK

1. Lesk AM, 2007, "Introduction to Genomics", Oxford University Press, IV Ed.
2. Brownstein M.J, 2003, "Functional genomics methods and protocols", Humana Press, III ed.
3. Weblink: nptel

BBTE11	ALTERNATE ENERGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Microbiology, Bioprocess Engineering, Chemical engineering				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To make students familiar with importance of alternative fuels

COURSE OUTCOMES (COs)

CO1	Learn limitations of fossil fuels and need for alternative fuels
CO2	Learn sources of various alternative flues
CO3	Learn storage, distribution and safety aspects of alternative fuels
CO4	To have an understanding of engine requirements and combustion characteristics fuels
CO5	To teach engine requirements and adaptability of engines to alternative fuels
CO6	To teach combustion and emission characteristics of various gaseous and liquid alternative fuels

UNIT I FOSSIL FUELS 9

Fossil fuels and their availability - Potential alternative liquid and gaseous fuels - Merits and demerits of various alternative fuels - Engine requirements

UNIT II PRODUCTION OF FUELS 9

Methods of production - Properties - Blends of gasoline and alcohol - Performance in SI engines – Adaptability - Combustion and emission characteristics - Performance in CI engines -Emission characteristics - Properties of alcohol esters

UNIT III NATURAL GAS 9

Production and properties of CNG, LPG, biogas and producer gas - Performance and emission in SI/CI engines - Storage, distribution and safety aspects

UNIT IV HYDROGEN FUELS 9

Sources of Hydrogen - Properties - Production of hydrogen - Transportation, storage and safety aspects - Performance and emission characteristics – Adaptability - Fuel cell - Hybrid vehicles

UNIT V BIOFUEL 9

Various vegetables oils - Properties - Esterification - Performance and emission characteristics - Bio-diesel: Feed stock, characteristics, preparation (lab and commercial), storage, applications, environmental impacts, economics, policy

TEXT BOOK

1. Osamu Hirao and Richard Pefley (1988), Present and Future Automotive Fuels, WileyInterscience Publication, New York.

REFERENCE BOOKS

1. R.L. Bechtold (1997), Alternative Fuels Guidebook, SAE
2. Nick Wagoner and Sheryl Wagoner (2006), Alternate Fuels: An Overview, ThomsonDelmar Learning.

3. Reda Mohamed Bata (1994), Alternate Fuels: A Decade of Success and Promise(Progress in Technology), SAE International

BBTE12	DEVELOPMENTAL BIOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biotechnology, Molecular biology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide basic knowledge about biology of human system

To provide knowledge about the designing of reactor

COURSE OUTCOMES (COs)

CO1	to understand the history and scope of developmental biology
CO2	to know about fertilization
CO3	to know basic concepts on cleavage
CO4	to know about regeneration
CO5	to study the various processes involved in regeneration
CO6	To study about human physiology

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	H	M	M	H	M	H				L		M
	CO2	H	M	M	H	H		M		M	L	L	
	CO3	H	M		H	H	H		H			L	M
	CO4	H	M		H	H		M		M	L		M
	CO5	H	M	M	H	H	M	M	H			L	M
	CO6	H			H	H			H	M	L	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Developmental biology: its scope, history and special fields-Germ cells: origin of germ cells, its migration and fate-Spermatogenesis: cells in seminiferous tubes, spermiotelosis, nuclear control of spermiotelosis, ultramicroscopic structure of mammalian sperm, types of sperm.

UNIT II OOGENESIS 9

Oogenesis: growth of oocyte, maturation of ovum, formation of yolk, accessory cells, egg cortex and its importance, egg membrane-Fertilization: significance of sperm-egg interaction, acrosome reaction, sperm penetration, behaviour of pronuclei, syngamy, polyspermy, activation of egg-Parthenogenesis: natural and artificial.

UNIT III CLEAVAGE 9

Cleavage: definition, early history and concept, geometry of cleavage, types of cleavage, cleavage patterns and factors governing them, laws of cleavage, theories of cytokinesis-Gastrulation: morphogenetic movements, selective affinity and adhesiveness of cells, mechanism of the change of shape of cell during morphogenesis-Embryonic induction: Spemann's primary organizer, nature of induction mechanism of action of inducing substances.

UNIT IV EMBRYO DEVELOPMENT 9

Organization of the early embryo: polarity, symmetry, regulative development and physiological gradients, mosaic development- Differentiation: equivalence of nuclei, cytoplasmic control of nuclear activity, genetic control of differentiation, isozymes, mass effects-Metamorphosis: insect metamorphosis, amphibian metamorphosis, metamorphosis and evolution.

UNIT V REGENERATION OF TISSUES AND ORGANS 9

Regeneration: regeneration in amphibians and planarian, stimulation and suppression of regeneration, histological processes concerned in regeneration, gradient concept, neural and endocrine influences- Developmental aspects of immunology- Teratology: factors inducing abnormal development of tissues and organs.

TEXT BOOK

1. B. Balinsky 2004, “An introduction to embryology”, 5th ed.

REFERENCES

1. J. Brachet, 2003, “Introduction to molecular embryology”.
2. N.J. Berrill, 2005, “Developmental biology”.
3. Gene activity in early development, (2005), H. Davidson.
4. Weblink: nptel

BBTE13	BIOPHARMACEUTICAL TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biochemistry, Bioorganic chemistry, Basic biotechnology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES:

To provide a basic understanding of pharmaceutics and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of drugs and its absorption
CO2	to know the manufacturing process of drugs and its bioavailability
CO3	to comprehend drugs and its binding mechanism

CO4	to know the drug metabolism and biotransformation
CO5	to get a basic knowledge of the applications of prodrugs in biological systems
CO6	To understand about the drug formulation

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	H	L	L	
	CO2	H	M	M	H	H					H	L	M
	CO3	H	M		H	H		M	M	M	M		M
	CO4	H	M			H		M				L	
	CO5	H	M	M	H	H		M	L	L			M
	CO6	H			H	H		M			L	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Introduction to bio pharmaceutics – Various route of drug administration- drug absorption, factors influencing drug absorption from the gastrointestinal tract.

UNIT II FORMULATION OF DRUGS 9

Manufacturing Principles - Compressed tablets - wet granulation - Dry granulation or slugging - Direct compression - Tablet presses formulation - Coating - Pills - Capsules - Parental solutions - injections

UNIT III PHARMACODYNAMICS 9

Binding of drugs to blood components - tissue binding of drugs - factors affecting protein drug binding - significance of protein/tissue binding of drugs - kinetics of protein-drug binding

UNIT IV BIOTRANSFORMATION 9

Biotransformation - drug metabolizing enzymes - phase I reactions - phase II reactions - first pass effect - factors affecting biotransformation of drugs - bio activation and tissue toxicity.

UNITV PRODRUGS 9

Bio precursor prodrugs - carrier prodrugs - application of prodrug design: - enhancement of bioavailability - site specific drug delivery - limitations of prodrug design.

TEXT BOOK

1. Brahmankar, D.M. "Biopharmaceutical and pharmacokinetics: A Treatise", VallabhPrakashan, 1995.

REFERENCE BOOK

1. Remington's Pharmaceutical Sciences, Mack Publishing and Co.,
2. Weblink: nptel

BBTE14	BIOFUEL TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biotechnology, Bioprocess				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES:

To provide a basic understanding of fuel and biofuel concepts and its production techniques

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of biofuel
CO2	to know the various source for biofuel
CO3	to apply the technique in large scale
CO4	to study about lipid derived biofuel
CO5	to give a basic knowledge of the applications biofuel
CO6	to get idea about various sources of biodiesel

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H		M		H		L	M	M
	CO2	H	M	M	H	H		M		H			
	CO3	H	M		H	H		M	M		M	L	M
	CO4	H	M		H		M	M		H			
	CO5	H	M	M	H	H			M			M	H
	CO6	H			H	H	L	M		H	L		H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Introduction – Potential of biomass – biofuel policies: Policy in EU – Biofuel standardization – International Trade of biofuel-Biofuel Life Cycle – Energy balance -& Efficiency of biofuel –

Biofuel emission: Greenhouse gas emission – Vehicle emission standards – other environmental Impacts of Biofuel – economy of biofuel – Consideration of Co-Products.

UNIT II BIOETHANOL 9

BioEthanol – Feed stock production: sugar Crops, Starch crops , Cellulosic feed stock – Bioethanol Production : Sugar to ethanol Process, Starch to ethanol process, Cellulose to Ethanol Process – Distillation & Dehydration process – Properties – Application –standardization – Energy balance – Bioethanol Emission : Greenhouse gas emission, toxic exhaust emission – Other environmental impacts: water issues, land use & biodiversity, human Health.

UNIT III LIPID BIOFUELS 9

Lipid derived Biofuel – Feed stock production -: Oil seed crops, Micro algae , Animal fats, waste oils – Fuel production : Oil Extraction , Oil Refining, Transesterification – Properties & Use : Properties of Pure Plant Oil (PPO) , Properties of Biodiesel – Application – Energy balance – Emissions of lipid biofuel – Other Environmental Impacts – Economy.

UNITIV BtL FUELS 9

BtL Fuel: Feed Stock production – BtL production – Gasification, Gas Cleaning – Synthesis process-Biohydrogen: Processing – Use – The Future of Biofuel.

UNIT V BIOMETHANE 9

Biomethane – Feed stock Production- BioMethane Production : Digestion Process- Digester types- biogas Purification – Properties & Use – Application – Standardization – BioMethane Emission – Other Environmental Effects – Economy.

TEXT BOOK

1. Dominik Rutz& Rainer Janssen, 2007, "Hand Book on BioFuel Technology", II ED.

REFERENCE BOOKS

1. SoetaertErlckI. Vandamme, 2009, "Biofuels" John Wiley & Sons, 1st.ed.
2. Hand Book on " BioFuel Technology" by Dominik Rutz& Rainer Janssen, 2007
3. "Bioprocess technology" – P.T. Kalaichelvan and I. Arul Pandi. 2007. MJP Pub.
4. CayeDrapcho, John Nghiem, Terry Warker, 2007, "Biofuel Engg& Process Technology" Mc-Graw Hill, 1sted.

BGE006	**BIOMEDICAL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biotechnology, Fermentation Techniques, Chemical reaction engineering, Bioprocess engineering				
	Course Designed by – Dept of Biomedical Engineering				
OBJECTIVES: To understand the working principle of various equipment					
COURSE OUTCOMES (COs)					
CO1	To understand the differences in the application of different microscopic methods				
CO2	Enables the student to develop their skills in the medical devices				

CO3	It also gives knowledge on rehabilitation biomechanics
CO4	It deals with bio signal analyzer
CO5	It imparts determination of ultrasound in diagnosis
CO6	To analyze the results of different spectrophotometer and identify the chemical nature of the samples

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M	L		L	L	M
	CO3	H	M		H	H		M		L	L	L	M
	CO4	H	M		H	H		M	M		L	L	M
	CO5	H	M	M	H	H		M		M	L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Anatomy of human-various bones-functions-muscles-types-function- Medical devices- Medical imaging- Implants- Bionics- The improvement of diagnosis and therapy; biomedical information storage and retrieval

UNIT II MUSCLE STRUCTURE AND ITS FUNCTIONS 9

Muscle structure and its attachment with skeleton-rate of contraction and force generation-Activation contraction-locomotion-stability-forces on ground-forces on muscles-energy requirement-mechanisms of walking, running and trotting-sports.

UNIT III BIOMECHANICS 9

Mechanical analysis of performance-rehabilitation biomechanics-mechanics of prosthetics and orthotics biomechanics of human injury and orthopaedics fixation-mechanics of bones and joint-dynamics of man machine interaction

UNIT IV BIOSYSTEM MODELING 9

Electrical impedance cephalography-biotelemetry-biosignalanalyzer-biosystem modelling

UNIT V ULTRASOUND IN DIAGNOSIS 9

Ultrasound in diagnosis-limb prosthetics and orthotics-sensory aids for the blinds-assisting the heart and kidney- ECG-EEB-Physiological equipment

TEXT BOOKS

1. AtillaHincal A., Suheylakas, H, BiomedicalScience&Technology, Plenum Press NewYork.
2. Albert D.Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007

REFERENCES BOOKS

1. Ernest o Doebelinand Dhanesh N Manik, Measurement systems, Application and design,5th edition,McGraw-Hill, 2007.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2003
3. Standard Handbook of Biomedical Engineering & Design – Myer Kutz, McGraw-Hill Publisher, 2003.

BBTE15	**METABOLIC ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Biochemistry, Metabolic conceptsand bioenergetics				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To have a detailed knowledge about the metabolic pathway of carbohydrates, proteins and fat and to engineer them based on industrial requirement

COURSE OUTCOMES (COs)

CO1	To learn the basic process of metabolism
CO2	To study the energetic of metabolism
CO3	To learn about metabolic stoichiometry
CO4	To explore the kinetics of metabolism
CO5	To study the various signal transduction pathways
CO6	To learn the concepts of metabolism and its kinetics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M		H	L	L	M
	CO2	H	M	M	H	H		M	L		L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M		M	L	L	M
	CO6	H			H	H		M	H		L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)

							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I METABOLISM 9

Metabolism- glycolsis, gluconeogenesis-glycogen-HMP shunt-TCA cycle-fatty acid metabolism-urea cycle and metabolism of purine and pyrimidine

UNIT II ENERGETICS 9

Energetics of metabolism, Energy coupling (ATP and NADH), Stoichiometry of cell growth and product formation, Elemental Balances, Degree of reduction, fundamental concepts, yield coefficients, oxygen consumption and heat evolution in aerobic cultures.

UNIT III STOICHIOMETRY 9

Metabolic stoichiometry, Energy of batch and continuous process, Stoichiometry of cell growth and product formation, available electron balances, yield coefficients of biomass and product formation, Maintenance coefficients, Energetic analysis of microbial growth and product formation, Heat evolution in anaerobic culture

UNIT IV THERMODYNAMICS 9

Thermodynamic efficiency of growth, Thermodynamics and kinetics of cell metabolism, metabolic path ways, modeling of EM pathway, Thermal Energetic studies, Activation Energies of reaction and heat of reaction, formation and combustion of biochemical reactions.

UNIT V SIGNAL TRANSDUCTION 9

Signal transduction- Receptors and Methods of action- Signal amplification and different models, G proteins- Phosphatidyl Inositol – cAMP – Calcium ions – Protein kinase- defects in signaling pathways.

TEXT BOOKS

1. Biochemical Engineering Fundamentals- Bailey and Olis, 2013

REFERENCE BOOKS

1. Roles JA Kinetics and Energetics in Biotechnology –Elsevier 1983
2. Chemical Reaction Engineering- Octave Levenspiel
3. Chemical process Principles vol III Bioprocess Engineering – Coulson and Richardson Wiley International 1986.
4. Weblink: nptel

BBA005	**ENERGY ENGINEERING AND MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Principles of chemical engineering, Thermodynamics, Environmental studies, basic concepts in energy				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

To enlighten the student in the field of energy engineering concern with energy efficiency, energy service and facility management

COURSE OUTCOMES (COs)

CO1	Understand different energy resources and their uses
CO2	Understand different energy conservation techniques
CO3	Understand the impact energy on environment
CO4	Know about management of energy
CO5	Calculate economics of energy
CO6	Understand different types of energy

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	H	M	M	H	M		M			M	M	M
	CO2	H	M	M	H			M					M
	CO3	H	M			H		M			L	M	
	CO4	H	M		H	H		M					M
	CO5	H	M	M	H	H		M			L	M	
	CO6	H						M					M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION TO ENERGY AND ENVIRONMENT 9

Definition – Fossil fuel reserves – Energy consumption – Greenhouse effect, global warming – Renewable energy resources – Environmental aspects, utilization – energy prizes – Energy policies.

UNIT II ENERGY CONSERVATION 9

Need – different types of energy conservation schemes – industrial energy use – energy surveying and auditing – energy index – cost of energy – cost index-energy conservation in engineering and process industry in thermal systems, in buildings and non-conventional energy resources schemes.

UNIT III ENERGY GENERATION BY TECHNOLOGY 9

Fuels and consumption – Boilers – Furnaces – Waste heat recovery systems – Heat pumps and refrigerators – Storage systems – Insulated pipe work systems – heat exchangers

UNIT IV ENERGY MANAGEMENT 9

Energy management principles – energy resource management – energy management information systems – Instrumentation and measurement – Computerized energy management

UNIT V ENGINEERING ECONOMICS 9

Costing techniques – Optimization cost – Optimal target investment schedules – Finance appraisal – Profitability – Project management.

TEXT BOOK:

1. W.R. Murphy and G. Mckay, Energy Management, Butterworths, London, 1982.

REFERENCE BOOK:

1. Callaghan P.W. Design and Management for Energy Conservation, Pergamon Press, Oxford,1993.

BBTE16	**NANOBIOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biotechnology, Molecular biology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide basic knowledge about nanoscience involved in biotechnology

COURSE OUTCOMES (COs)

CO1	to understand the various nano devices
CO2	to know about nano molecules
CO3	to learn the applications of nanotechnology in proteins, lipids and nucleic acids
CO4	to know about the applications of nanotechnology in microbiology
CO5	to know about nano technology involved in drug delivery system
CO6	To understand about nanoparticles

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	M	M	M	H	M		H				L	M
	CO2	H	M	M	H	H		M			L		L
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H					L	L	M
	CO5	H	M	M	H	H		M				L	L
	CO6	H			H	H		M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Introduction to nanobiotechnology – nanodevices& techniques – micro &nanosystems – synthesis & characterization of nanoscale molecules – nanoarchitecture – fabrication technologies – self-assembly systems

UNIT II NANODEVICES 9

Inorganic nanoscale systems – properties of fullerene carbon nano tubes – quantum dots & wires – gold nanoparticles – nanopores.

UNIT III NANOMOLECULES 9

Nanomolecules in proteins, lipids RNA & DNA – peptide coupled nanoparticles – proteins nanodevices – cell nanotechnology – cell motility – nanomotors& cellular navigation – chemotaxis – transmembranesignaling – nanoscale artificial platform.

UNIT IV MICROBIAL NANOTECHNOLOGY 9

Nanotechnology and microorganisms – PHA – magnetosomes – cyanophycin inclusions – alginates – bacteriophages – bacterial spores – S – layer proteins – bacteriorhodopsin.

UNIT V NANOMEDICINE 9

Nanotechnology in drug delivery – nanoscale devices for drug delivery – micelles – protein targeting – protein interaction with other molecule – microarray – genomic chips – nanobiosensors – nanobiochips – Nanotechnology for cancer diagnosis & treatment.

TEXT BOOK

1. K.K. Jain , 2006, "Nanotechnology in molecular diagnostics – current techniques & applications", Horizon Bioscience publishers

REFERENCE BOOKS

1. Microbial bionanotechnology:Biological Self-Assembly Systems and Biopolymer-Based Nanostructuresed: Bernd Rehm, Taylor and Francis, 2006
2. Applications of nanoparticles in biology & medicine O.V. Salata, Journal of nanobiotechnology (2004),
3. Weblink: nptel

BCE057	INDUSTRIAL WASTE TREATMENT AND DISPOSAL	L	T	P	C

	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Environmental biotechnology, Waste management				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

To provide knowledge on sources and characteristics of industrial wastewater,techniques and approaches for minimizing the generation and application of physio chemical and biological treatment methods for recovery, reuse and disposal

COURSE OUTCOMES (COs)

CO1	Have a fundamental knowledge of the effluent discharge standards and waste minimization technology
CO2	Have a well-founded knowledge of characteristics of industrial wastewaterand treatment methods
CO3	Acquire knowledge about conventional methods of treatment for industrial waste
CO4	Understand various biological treatment methods
CO5	Have a fundamental knowledge of combined treatment of industrial and municipal wastes
CO6	Have knowledge about various types of effluent released from industries

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	M	M	M	H	M	H	M	L		L	L	M
	CO2	H	M	M	H	H	H	M		H	L	L	M
	CO3	H	M		H	H	M	M	H		L	L	M
	CO4	H	M		H		H	M	M	M	L	L	M
	CO5	H	M	M	H	H	M	M			L	L	M
	CO6	H			H	H	H	M		L	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Effects of industrial wastes on streams, land and air, waste water treatment plants, water quality criteria – effluent standards : Process modification, method and material changes, housekeeping etc., to reduce water discharges and strength of the waste and established recovery methods for bye products within the plant operations.

UNIT II CHARACTERISTICS OF WASTE 9

Characteristics of major industrial waste water (liquid wastes) Chemical Industries: Petrochemicals & refineries, pharmaceuticals. Apparel Industries: Textile, synthetic fibres, leather, paper-Agro Industries: Fertilizer Food Industries: Heat – packing pickles, canning poultry and eggs, distillers, sugar. Metallurgical Industries: Thermal power station, nuclear power plants.

UNIT III WASTE TREATMENT 9

Conventional methods of treatment and disposal of industrial wastes-Equalization and neutralization, separation of solids – sedimentation and filtrations

UNIT IV BIOLOGICAL TREATMENT 9

Removal of organic contents: Biological treatment methods, aerobic and anaerobic, digestion, tickling filters, stabilization ponds, activated sludge process – oxidation ditch.

UNIT V PHYSICOCHEMICAL TREATMENT 9

Physico Chemical Treatment Method – Neutralization, coagulation, flocculation, adsorption and precipitation. Combined treatment of industrial and municipal wastes.

TEXT BOOKS:

1. EckenfalderW.W,"Industrial Water Pollution Control", McGraw Hill, New York, 1989

REFERENCES:

1. Arceivala S.J &ShyamAsolekarR,"Waste Water Treatment and Pollution Control Tata McGraw Hill, 1998.
2. Nelson Leonard Nemerow," Theories and practice of industrial waste treatment", Addison Wesley Pub. Co., 1963
3. World Bank Group "Pollution prevention and Treatment Hand Book" World Bank and UNEP Washington DC, 1998

BBTE17	ENGINEERING OPTIMIZATION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engg Mathematics-I, Input and output ,Engineering concepts				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide knowledge about the process optimization

COURSE OUTCOMES (COs)

CO1	To understand the fundamentals of process optimization
CO2	To know about various optimization methods
CO3	To know about statistical approach
CO4	To understand the linear programming methods
CO5	To know the yield and economic importance
CO6	To understand about neural network

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	D	E	F	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M		H	L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M	M	M	L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M	L	M	L	L	M
	CO6	H			H	H		M			L	L	M
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)		Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)		
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4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION 9

Introduction to Optimization, Necessity and need for process optimization- Necessary and Sufficient Conditions for Extremum-Maxima and minima- Local maxima, local minima, global maxima, global minima

UNIT II ONE DIMENSIONAL OPTIMIZATION 9

Optimization of Unconstrained Functions: One-Dimension. Newton Ralpson Method- Bisection Method- Interval Halving Method

UNIT III MULTI-DIMENSIONAL OPTIMIZATION 9

Optimization of Unconstrained Functions: Multi-DimensionalOptimization by Generalized Reduced-Gradient method (deterministic process optimization) -Statistical Modeling (empirical process optimization, experimental design and analysis) -Taguchi Method (process optimization) -Random Search Method -Fuzzy Logic (process optimization, control systems) -Linear Programming (process optimization)

UNIT IV STATISTICAL OPTIMIZATION 9

Linear Programming - Simplex Method-The Nonlinear Problem with Constraints-Statistical Approaches

UNIT V PROCESS OPTIMIZATION 9

Neural Networks (process optimization, control systems) - Genetic Algorithms (process optimization) - Optimization of Systems with Discrete Variables (process design)

TEXT BOOK

1. Singiresu S. Rao, 2005, “Engineering Optimization Theory and Practice”, Third Edition.

REFERENCE BOOKS

1. Ananthakrishnan TN,2006, "Animal biodiversity" Scientific publishers(India).
2. Good enough U,1998, "Human biology; personal, environmental and social concerns" Saunders collage publication.

BBA008	**TOTAL QUALITY MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional ethics& Professional Courses				
	Course Designed by – Dept of Management studies				

OBJECTIVES:

To study about the management methods involved in quality assessment of a product

COURSE OUTCOMES (COs)

CO1	to study the basic definition of quality
CO2	to study the importance of customer satisfaction
CO3	to study the statistical methods of quality control
CO4	to explore the methods of benchmarking
CO5	to classify the products into quality standards
CO6	To know about quality principle

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M		L	L	L	M
	CO2	H	M	M	H	H		M	L		L	L	M
	CO3	H	M		H	H	L	M		M	L	L	M
	CO4	H	M		H	H		M	M		L	L	M
	CO5	H	M	M	H	H		M		L	L	L	M
	CO6	H			H	H	L	M	L		L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Definition of Quality, Dimensions of quality, Quality planning, Quality costs- Analysis – Techniques for quality costs, Basic concepts of total Quality Management, Historical Review, Principles of TQM, Leadership- Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation

UNIT II TQM PRINCIPLES 9

Customer satisfaction-Customer Perception of Quality, Customer complaints, Service Quality, Customer Retention and, Employee Involvement- Motivation, Empowerment, Teams, Recognition Reward, Performance Appraisal, Benefits, Continuous process improvement- Jurantrlogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership- Partnering, sourcing, Supplier selection, Supplier rating, relationship development, Performance measure- Basic concepts, Strategy, Performance measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, Statistical Fundamentals- Measures of central Tendency and Dispersion, Population and sample, Normal curve, Control charts for variables and attributes, Process capability, Concept of six sigma, New seven management tools.

UNIT IV TQM TOOLS 9

Benchmarking- Reasons to Benchmark, Benchmarking process, Quality function Deployment (QFD)- House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM)- Concept, Improvement Needs, FMEA- Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and other Quality Systems, ISO 9000:2000 Quality system- Elements, Implementation of Quality systems, Documentation, Quality Auditing,
QS 9000, ISO 14000- Concept, Requirements and Benefits.

TEXT BOOK

1. R.Ramakrishnan, 2004, “A Text Book of Total Quality Management” V Ed.

REFERENCE BOOKS:

1. Ronald A. Armstrong , 2006, "Total Quality management", Chapman and Hall,
2. Suresh Lulta, 2002"Total Quality management" Vol. I and ll, ShahTrust, Mumbai

BBA009	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Value Education and Professional Ethics & Professional Courses				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

Strong intellectual property rights (IPR) protection is crucial to fostering trade, and achieving the goals and benefits of global integration. Countries with high standards of IPR protection tend to attract more investment, stimulate more innovation, thereby

developing more rapidly. Countries with inadequate protection are often vulnerable to infringements of intellectual property rights that hinder trade flow and economic development.

Hence, the objective is to introduce IPR to the UG Engineering and Technology students.

COURSE OUTCOMES (COs)

CO1	Understand the principles, function and basic legal rules of IP Law.
CO2	Recognize the relevant criteria for generating and protecting intellectual works.
CO3	Recognize the intellectual property likely to be produced in the academic and professional environment.
CO4	Demonstrate appreciation and critical awareness of pertinent IP issues in the academic and professional lives.
CO5	Understand the relevance and impact of IP Law on academic/scientific works/studies.
CO6	Understand the different forms of infringement of intellectual property rights.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					H					H	
	CO2		H		M					H			
	CO3	M							M		H		
	CO4			M	H							H	
	CO5							M					
	CO6	H			H					M			L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I PROPERTIES AND TYPES 9

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i). Movable Property ii. Immovable Property and iii. Intellectual Property.

UNIT II PATENTS AND RIGHTS 9

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures..

UNIT III INTERNATIONAL TRADE 9

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV WTO 9

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V CASE STUDIES 9

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TEXT BOOKS:

1. Subbaram N.R. "Handbook of Indian Patent Law and Practice ", S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.

REFERENCES:

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.
4. www.ipmatters.net/features/000707_gibbs. html.
5. http://www.metastudio.org/Science%20and%20Ethics/file/readDoc/535a76367d9d331598f49e2d/34_Hb_on_IPR.pdf

BCE059	ENVIRONMENTAL HEALTH ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Waste Management				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

To give an insight into the various diseases that affect human beings and introduces the importance of sanitation processes

COURSE OUTCOMES (COs)

CO1	To learn about the various environmental pollution and the impacts of land use and overuse of natural resources
CO2	To learn the various water acts and the sources of water pollution
CO3	To learn the various Air acts and the sources and the effects of Air and noise pollution
CO4	Insight into the solid waste management and various disposal techniques
CO5	Insight into food sanitation and the effects of food borne diseases
CO6	To acquaint the student with various methods and techniques of disposing and management of waste

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M	H	M	H		L	L	M
	CO2	H	M	M	H	H	H		H	H	L	L	M
	CO3	H			H	H	H	M	H	M	L	L	M
	CO4	H	M		H	H	H		H	M	L	L	
	CO5	H	M	M	H	H	H	M	H	L	L	L	M
	CO6	H			H	H	H		H	M	L	L	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term paper Seminar/ Internship (PR)
											√		
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION **9**

Impact of Development and Water Pollution – Ecology and ecosystems Impact of development, land use and natural resource management, Cause and effects of environmental pollution

UNIT II SOURCES OF POLLTION **9**

Natural Processes: Pollution due to industrial, agriculture and municipal wastes – Limitation of disposal of dilution. BOD considerations in streams- Water Pollution control legislation.

UNIT III AIR POLLUTION **9**

Air and Noise Pollution and Control- Pollutants and their sources- Effect of pollution of human wealth, vegetation- Air pollution control legislation -noise pollution- sources and effects – Control measures.

UNIT IV SOLID WASTE MANAGEMENT **9**

Solid Wastes Management and Water Control Sources - Characteristics Quantities – Collection methods and disposal techniques - Sanitary -landfill -Incineration and pyrolysis – composting - water borne diseases – of mosquitoes, flies, rodents.Rational control and naturalistic methods of control, uses and limitations of pesticides, engineering measures of water control.

UNIT V FOOD SANITATION **9**

Food & Milk Sanitation : Relation of food to disease – principles of food sanitation – Sanitation of Kitchen in restaurants and other catering establishments – Quality changes in milk – Milk as carrier of infection – Pasteurization of milk – HTST and LTLT processes. Cattle shed sanitation.

TEXT BOOKS

1. Ehlws V.M. and E.W. Steel. Municipal and Rural Sanitation – McGraw Hill Co. Inc, New York, 1954

REFERENCES

1. Park J.E. and Park K.,"Text Book of Preventing and Social Medicine",M/s. Banarsidos, Bhanot, Jabalpur, 1980.
2. Stern A.C. *ed,* "Air Pollution Vol. I, II & III", Academic Press, New York, 1968
3. Cuniff P.E,"Environmental Noise Pollution", John Wiley & Sons, New York. 1977.

BBTE18	**INDUSTRIAL SAFETY ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioprocess, Enzyme Engineering & Technology, Basic Biotechnology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge about Safety engineering

COURSE OUTCOMES (COs)

CO1	to understand basic concepts in hazard analysis
CO2	to know about safety and its management
CO3	to know about accidents and its preventive measures
CO4	to understand various personal protective equipment and first aid
CO5	to know about personal protective equipment
CO6	To know about fire and safety

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	M		L		M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M		M	L	L	M
	CO4	H	M		H	H		M	L		L	L	
	CO5	H	M	M	H	H		M		L	L		M
	CO6	H			H	H		M			L	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INDUSTRIAL HAZARDS 9

Safety in Process Plants – Hazard Analysis – Types of Hazard – hazard Identification techniques Hazard Evaluation – Important Factories Act.

UNIT II CHEMICAL HAZARD 9

Hazards in work place: safety in the use of chemicals at work – Chemical hazard - Air-Borne Contaminants – particulate matter – Hazard and safety methods – hazards and Safety measures in Refineries , Paper and Pulp Industries- Safety Conditions in tanneries –Hazards of Pesticide – Sugar industry.

UNIT III SAFETY MANAGEMENT AND FIRE SAFETY 9

Introduction- Safety policy- Safety in electrical installation: Electrical shock and prevention-safety precautions for residential and commercial installation - Case study-Four stages of Fire-types of Fire Detectors – Fire safety in Industry – chemistry of fire- Types of Combustion- Fire Triangle- Fire extinguishing Technique – Engineering consideration for safety consideration

UNIT IV INDUSTRIAL ACCIDENTS 9

Industrial accidents – Classification – prevention – accident cost – Steps of investigation – Analysis of Accidents – Remedial Measures – Methods of Prevention – Safety Slogans – Case study

UNIT V PROTECTIVE EQUIPMENTS 9

Personal protective Equipment and personal Protection – Aim – Need – Types: Non Respiratory Protective equipment- Respiratory typeFirst aid – principles and methods – First aid training – Scope of first aid – Golden rules– First aid treatment : for wounds and Hemorrage , Shock , respiration :Schafer's Method, Shock. Fractures, Burns and Scalds, Unconsciousness, Heat exhaustion and Stroke– First aid Kit box A and B.

TEXT BOOK:

1. Nicholas, 2008, "Practical Guidance to Industrial Safety" 3rd ed
2. M.H.Fulekar, 2007, "Industrial Hygiene & chemical Safety" 2nd ed

REFERENCE BOOKS:

1. Rudd,2005, "Strategy of process engineering" Willey
2. Wang, Shannmas Hung, 2008, "Advanced hazardous industrial waste treatment" CRC Press.

BBTE19	**BIOENTREPRENEURSHIP DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept of Industrial Biotechnology				
OBJECTIVES: To provide basic knowledge about Entrepreneurship					
COURSE OUTCOMES (COs)					
CO1	to understand the fundamentals of Entrepreneurship				
CO2	to know about time management				

CO3	to explore the avenues for financing a business venture
CO4	to know about various company laws
CO5	to understand Entrepreneurship in biotechnology
CO6	To get knowledge about decision making

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	H		M	H	M	M	M				L	
	CO2	H	M	M	H	H		M		M	L	L	M
	CO3	H	M	M	H	H	L		H		L		M
	CO4	H	M			H		M			L	L	M
	CO5	H	M	M	H	H		M		M	L	L	M
	CO6	H			H	H	M	M	M		L	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I ENTREPRENEURSHIP FUNDAMENALS 9

Entrepreneur – Entrepreneurship – Enterprise – Writing good business plan – operations and management.

UNITII DECISION MAKING AND TIME MANAGEMENT 9

Entrepreneur psychology – personal decision making style – Decision making process – setting personal and Business goals – Setting time priorities – Business person working at home.

UNIT III FINANCE AND ECONOMIC FEASIBILITY 9

Financing the business– Raising venture capital – Financing sources – Pricing the product (or) Service – operating expenses Economic Analysis – Basic financial Analysis worksheets

UNIT IV COMPANY LAWS AND REGULATIONS 9

Forming company – Types of companies – Types of market – Proprietary information: Intellectual property, copy right, ownerships, Trademark, Patent – International Trade

UNIT V ENTREPRENEURSHIP IN BIOTECHNOLOGY 9

Various business opportunities in Biotechnology – Development of Biotech companies in India – Case studies on Biotech companies and its growth

TEXT BOOK

1. Exploring Entrepreneurship: D. Allan Barefield and George F. Smith, Ettmae Westbrook,

Tennesse State University, 2006

REFERENCE BOOK

1. Entrepreneurship fundamentals by ZobiasKollmann International journal of Technology management,2007