B.Sc., BIOTECHNOLOGY
CHOICE BASED CREDIT SYSTEM (CBCS)

Curriculum and Syllabus
Regular (2018-2019)

DEPARTMENT OF BIOTECHNOLOGY
FACULTY OF ARTS, SCIENCE AND HUMANITIES
KARPAGAM ACADEMY OF HIGHER EDUCATION  
(Deemed to be University)  
(Established under Section 3 of UGC Act, 1956)  
Eachanari Post, Coimbatore - 641 021, India

FACULTY OF ARTS, SCIENCE AND HUMANITIES
UNDER-GRADUATE PROGRAMMES

REGULAR PROGRAMME

REGULATIONS - 2018
CHOICE BASED CREDIT SYSTEM (CBCS)

The following regulations are effective from the academic year 2018-2019 and are applicable to candidate admitted to Under Graduate Degree (UG) programmes in the Faculty of Arts, Science, and Humanities, Karpagam Academy of Higher Education (KAHE) from the academic year 2018-2019 onwards.

1 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

1.1 U.G. Programmes Offered
A candidate may undergo a programme in any one of the under graduate programme approved by the KAHE as given below.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>DEGREE</th>
<th>DISCIPLINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B. Sc.</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>2</td>
<td>B. Sc.</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>3</td>
<td>B. Sc.</td>
<td>Computer Science</td>
</tr>
<tr>
<td>4</td>
<td>B.Sc.</td>
<td>Mathematics</td>
</tr>
<tr>
<td>5</td>
<td>B.Sc.</td>
<td>Physics</td>
</tr>
<tr>
<td>6</td>
<td>B. Sc.</td>
<td>Chemistry</td>
</tr>
<tr>
<td>7</td>
<td>B. Sc.</td>
<td>Microbiology</td>
</tr>
<tr>
<td>8</td>
<td>B. Sc.</td>
<td>Information Technology</td>
</tr>
<tr>
<td>9</td>
<td>B. Sc.</td>
<td>Computer Technology</td>
</tr>
<tr>
<td>10</td>
<td>BCA</td>
<td>Computer Application</td>
</tr>
<tr>
<td>11</td>
<td>B. Com.</td>
<td>Commerce</td>
</tr>
<tr>
<td>12</td>
<td>B.Com (CA)</td>
<td>Commerce with Computer Applications</td>
</tr>
<tr>
<td>13</td>
<td>B. Com. (PA)</td>
<td>Commerce with Professional Accounting</td>
</tr>
<tr>
<td>14</td>
<td>B. Com. (BPS)</td>
<td>Commerce with Business Process Services</td>
</tr>
<tr>
<td>15</td>
<td>B.B.A.</td>
<td>Business Administration</td>
</tr>
</tbody>
</table>
1.2 Mode of Study

**Full-Time**
Candidates admitted under ‘**Full-Time**’ should be present in the KAHE during the complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

1.3 Eligibility for Admission

A candidate for admission to the first year of the UG Degree programme shall be required to have passed the Higher Secondary Examination (10 + 2) [Academic or Vocational] prescribed by the Government of Tamil Nadu Board or any similar examination of any other Board accepted by the KAHE as equivalent thereto.

2. DURATION OF THE PROGRAMMES

2.1 The minimum and maximum period for the completion of the U.G. Programmes are given below:

<table>
<thead>
<tr>
<th>Programme</th>
<th>Min. No. of Semesters</th>
<th>Max. No. of Semesters</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.A, B.Sc., B.Com, BCA, BBA</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>

2.2 Each semester normally consists of 90 working days or 450 Instructional hours of study. Examination shall be conducted at the end of every semester for the respective courses.
3. CREDITS
Credit means the weightage given to each course of study by the experts of the concerned Board of Studies. Total credits 144 as per UGC Guidelines for the UG programme (Three Years).

4. STRUCTURE OF THE PROGRAMME

4.1 Tamil or any one of the Indian / Foreign Languages viz, Malayalam, Hindi, French, Sanskrit as an additional course for Science Programme. Four credits are awarded for each course and the examinations will be conducted at the end of the each semester.

For Arts programme, there are two additional courses (English III and IV) offered during the Second year - third and fourth semester. Six credits are awarded for each course, and the examinations will be conducted at the end of the each semester.


a. Core Course
Core consists of theory and practical for Department domains for which examinations shall be conducted at the end of each semester. The students have to study 12 Core Courses compulsorily.

b. Discipline Specific Electives
There are six Discipline Specific Elective Courses (DSE) for Science Programme. DSE is offered in the fifth and sixth semesters of third year. The examination shall be conducted at the end of each semester. Final year students (V and VI Semesters) will have to choose three elective courses in V semester and two elective courses in the VI Semester from the list of elective courses given in the curriculum, in addition to the project work.

There are four Discipline Specific Elective Courses for Arts Programme. DSE is offered in the fifth and sixth semesters of third year programme. The examination shall be conducted at the end of each semester. Final year students (V and VI Semesters) will have to choose two elective courses in V semester and two elective courses in the VI Semester from the list of elective courses given in the curriculum.
c. **Generic Elective**

An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

The students in the Final year Arts programme have to choose two Generic Electives - one each in the Fifth and Sixth Semester from the list of elective courses given in the curriculum.

**Note:** A particular elective course will be offered if at least one third of the class opt that course. If less, the elective selected may be studied as a self study course.

d. **Skill Enhancement Courses**

Skill Enhancement Courses are offered in the third and fourth semesters of second year programme and in the fifth and sixth semesters of the third year programme. Second year students (III and IV Semesters) will have to choose one elective course each in both III and IV Semesters from the list of elective courses given in the curriculum. Similarly final year students (V and VI Semesters) will have to choose one elective course each in both V and VI Semesters from the list of elective courses given in the curriculum. The examination shall be conducted at the end of each semester.

**Note:** A particular elective course will be offered if at least one third of the class opt that course. If less, the elective selected may be studied as a self-study course.

e. **Project Work**

The project work shall start at the beginning of sixth semester and Project Report shall be submitted at the end of the sixth semester. The project shall be an individual or group task. HoD of the department concerned shall assign a project supervisor who in turn shall monitor the project work of the student(s). A project/ dissertation work may be given *in lieu* of a discipline-specific, elective paper.

f. **Ability Enhancement Compulsory Course**

**Ability Enhancement Compulsory Course-1**

The course (English for Science Programme / Business Communication for Arts Programme) shall be offered during the first semester for which examinations shall be conducted at the end of the semester.
Ability Enhancement Compulsory Course-2

Students shall study the course Environmental Studies in the second Semester for which examinations shall be conducted at the end of the semester.

Online Course
Student shall study at least one online course from SWAYAM / NPTEL / MOOC in any one of the first five semesters for which examination shall be conducted at the end of the course by the respective organizations. The student can register to the courses which are approved by the Department. The student shall produce a pass certificate from the respective organizations before the end of the fifth semester. The credit(s) earned by the students will be considered as additional credit(s) over and above the required credits earned from programme concerned.

Extension Activities
Every student is encouraged to participate in at least any one of the following activities:

- NSS
- NCC
- Sports / Mass drill
- YRC
- Club activities
- Other Co-curricular and Extra curricular activities

The student’s performance shall be examined by the staff in-charge of Extension Activities along with the faculty tutor and the Head of the respective department on the following parameters.

- 75 % weightage for active participation in Extension Activities in / out of the KAHE.
- 25 % weightage for Exemplary Awards / Honours / Prizes.

Marks for Co-curricular and Extra-curricular shall be sent to the CoE before the commencement of the sixth End Semester Examinations. The mark sheet will carry the following remarks as per the following range of marks.
The above activities shall be conducted outside the regular working hours of the KAHE.

5. MEDIUM OF INSTRUCTION
The medium of instruction and examinations for the courses under Language I – Tamil / Hindi / Malayalam / French / Sanskrit shall be in the language concerned. For all other courses, the medium of instruction and examination shall be in English.

6. MAXIMUM MARKS
Each of the theory and practical courses shall carry a maximum of 100 marks. Out of which 40 marks is awarded for Continuous Internal Assessment (CIA) and 60 marks for End Semester Examinations (ESE).

Evaluation: Evaluation in the courses comprises two parts, one is the Continuous Internal Assessment (CIA) and the other one is the End Semester Examination (ESE).

7. REQUIREMENTS TO APPEAR FOR THE END SEMESTER EXAMINATION
a. Ideally, every student is expected to attend all classes and secure 100% attendance. However, in order to allow for certain unavoidable circumstances, the student is expected to attend at least 75% of the classes and the conduct of the candidate has been satisfactory during the course.

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

c. However, a candidate who has secured attendance less than 64% in the current semester due to any reason shall not be permitted to appear for the current semester examinations. But he/she will be permitted to appear for his/her supplementary examinations, if any and he/she has to re-do the same semester with the approval of the “Students’ Affairs Committee” and Registrar.

8. a. FACULTY TUTOR
To help students in planning their courses of study and for general advice on the academic programme, the HoD shall allot a certain number of students to a faculty to whom they shall function as faculty tutor throughout their period of study. Faculty tutors shall advise the students and monitor their conduct of behavior and academics. Problems if any, they should be counseled periodically. The Faculty tutor is also responsible to inform the parents of their wards’ progress. Faculty tutor shall display the cumulative attendance particulars of his / her ward students’ periodically (once in 2 weeks) on the Notice Board to enable the students know their attendance status and satisfy the clause 7 of this regulation.

b. ONLINE COURSE COORDINATOR
To help students in planning their online courses and for general advice on online courses, the HOD shall nominate a coordinator for the online courses. The Online course coordinator shall identify the courses which students can select for their programme from the available online courses offered by the different agencies periodically and inform the same to the students. Further, the coordinator shall advice the students regarding the online courses and monitors their course.

9. CLASS COMMITTEE
Every class shall have a class committee consisting of the faculty members of the various courses of the class concerned, student representatives (Minimum 2 boys and 2 girls of various capabilities and Maximum of 6 members) and the concerned HoD / senior faculty as Chairperson. The objective of the Class Committee Meeting is all about the teaching – learning process. Class Committee may be convened at least once in a month. The functions of the class committee include
• Analysing and solving problems experienced by students in the classroom and in the laboratories.

• Analyzing the performance of the students of the class after each test and finding the ways and means to improve the performance.

• The class committee of a particular class of any department is normally constituted by the HoD / Chairperson of the class Committee. However, if the students of different departments are mixed in a class, the class committee is to be constituted by the respective Dean of the Faculty.

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

• The HoD / Chairperson of the Class committee may convene the meeting of the class committee.

• The respective Dean of the Faculty may participate in any Class committee meeting.

• The Chairperson is required to prepare the minutes of every meeting, and submit the same to Dean concerned within two days after having convened the meeting. Serious issues if any shall be brought to the notice of the Registrar by the HoD / Chairperson.

10. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or department shall have a “Course committee” comprising all the teachers handling the common course with one of them nominated as Course Coordinator. The nomination of the course coordinator shall be made by the respective Dean depending upon whether all the teachers handling the common course belong to a single department or to various other departments. The ‘course committee’ shall meet in order to arrive at a common scheme of evaluation for the tests and shall ensure a uniform evaluation of the tests. If feasible, the course committee shall prepare a common question paper for the Internal Assessment test(s).

11. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

11.1 Attendance and assessment: Every Faculty is required to maintain an Attendance and Assessment Record (Log book) which consists of attendance marked in each lecture / practical / project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the HoD once in a fortnight for checking the syllabus coverage and the records of test marks and attendance. The HoD shall sign with date
after due verification. The same should be submitted to respective Dean once in a month. After the completion of the semester the HoD should keep this record in safe custody for five years. Because records of attendance and assessment shall be submitted for Inspection as and when required by the KAHE / any other approved body.

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

**Theory Courses**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Category</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Assignment*</td>
<td>5</td>
</tr>
<tr>
<td>2.</td>
<td>Attendance</td>
<td>5</td>
</tr>
<tr>
<td>3.</td>
<td>Seminar</td>
<td>5</td>
</tr>
<tr>
<td>4.</td>
<td>Test – I (1 ½ units- Unit I and II)</td>
<td>8</td>
</tr>
<tr>
<td>5.</td>
<td>Test – II (1 ½ units Unit II and III)</td>
<td>8</td>
</tr>
<tr>
<td>6.</td>
<td>Test III (2 units Unit IV and V)</td>
<td>9</td>
</tr>
</tbody>
</table>

**Continuous Internal Assessment: Total** 40

* Two Assignments (Assignment I before Internal Test – I and assignment II before Internal Test – II).

**Practical Courses**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Category</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Attendance</td>
<td>5</td>
</tr>
<tr>
<td>2.</td>
<td>Observation work</td>
<td>5</td>
</tr>
<tr>
<td>3.</td>
<td>Record work</td>
<td>5</td>
</tr>
<tr>
<td>4.</td>
<td>Model Examination</td>
<td>20</td>
</tr>
<tr>
<td>5.</td>
<td><em>Viva – voce</em> [Comprehensive]*</td>
<td>5</td>
</tr>
</tbody>
</table>

**Continuous Internal Assessment: Total** 40

* Includes *Viva- voce* conducted during the model Exam practical.

Every practical Exercise / Experiment shall be evaluated based on the conduct of Exercise/ Experiment and records maintained.
11.3 Pattern of Test Question Paper
Portions for Internal Test – I: First 1½ Units (Unit I and II)
Portions for Internal Test – II: Second 1½ Units (Unit II and III)
Portions for Internal Test – III: Two units (Unit IV and V)

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Marks</td>
<td>50 marks</td>
</tr>
<tr>
<td>Duration</td>
<td>2 Hours</td>
</tr>
<tr>
<td>Part – A</td>
<td>Objective type (20x1=20)</td>
</tr>
<tr>
<td>Part - B</td>
<td>Short Answer Type (3 x 2 = 6)</td>
</tr>
<tr>
<td>Part - C</td>
<td>3 Eight mark questions ‘either – or’ choice</td>
</tr>
<tr>
<td></td>
<td>(3 x 8 = 24 Marks)</td>
</tr>
</tbody>
</table>

11.4 Attendance

Marks Distribution for Attendance

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Attendance (%)</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>91 and above</td>
<td>5.0</td>
</tr>
<tr>
<td>2</td>
<td>81 - 90</td>
<td>4.0</td>
</tr>
<tr>
<td>3</td>
<td>76 - 80</td>
<td>3.0</td>
</tr>
<tr>
<td>4</td>
<td>Less than 75</td>
<td>0</td>
</tr>
</tbody>
</table>

12. KAHE EXAMINATIONS

12.1 End Semester Examination (ESE): End Semester Examination will be held at the end of each semester for each course. The question paper is for maximum 60 marks.

Pattern of ESE Question Paper:

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Marks</td>
<td>60 marks for ESE.</td>
</tr>
</tbody>
</table>
12.2 **Practical:** There shall be combined valuation. The pattern of distribution of marks shall be as given below.

- **Experiments:** 40 Marks
- **Record:** 10 Marks
- **Viva-voce:** 10 Marks

Total: 60 Marks

**Record Notebooks for Practical Examination**

Candidate taking the practical examination should submit Bonafide record notebook prescribed for the practical examination; Failing which the candidate will not be permitted to take the practical examination.

In case of failures in Practical Examination, the marks awarded for the record at the time of first appearance of the Practical Examination should remain the same at the subsequent appearance by the candidate.

**12.3. Evaluation of Project Work**

12.3.1 The project work shall carry a maximum of 100 marks. (CIA - 40 and ESE – 60*)

*Combined valuation of Internal and External Examiners.
12.3.2 The project report prepared according to approved guidelines and duly signed by the supervisor(s) shall be submitted to HoD.

12.3.3 The evaluation of the project will be based on the project report submitted and a *viva-voce* Examination by a team consisting of the supervisor, who will be the Internal Examiner and an External Examiner who shall be appointed by the KAHE. In case the guide is not available, the HoD shall act as an Internal Examiner for the same.

12.3.4 If a candidate fails to submit the project report on or before the specified date given by controller of examinations office, candidate is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester.

If a candidate fails in the respective viva-voce examinations he/she has to resubmit the Project Report within 30 days from the date of declaration of the results. For this purpose the same Internal and External examiner shall evaluate the resubmitted report.

12.3.5 Copy of the approved project report after the successful completion of *viva-voce* examinations shall be kept in the KAHE library.

13. PASSING REQUIREMENTS

13.1 Passing minimum: There is a passing minimum for CIA and it is 20 marks out of 40 marks. The passing minimum in ESE is 30 marks out of 60 marks. The overall passing in each course is 50 out of 100 marks (Sum of the marks in CIA and ESE examination).

13.2 If a candidate fails to secure a pass in a particular course (either CIA or ESE or Both) as per clause 13.1, it is mandatory that the candidate has to register and reappear for the examination in that course during the subsequent semester when examination is conducted for the same till a pass is secured both in CIA and ESE (vide Clause 2.1).

13.3 Candidate failed in CIA will be permitted to improve CIA marks in the subsequent semesters by writing tests and by submitting Assignments.

13.4 CIA marks (if it is pass) obtained by the candidate in the first appearance shall be retained by the Office of the Controller of Examinations and considered valid for all subsequent attempts till the candidate secures a pass in ESE
13.5 Candidate who is absent in ESE in a Course / Practical / Project Work after having enrolled for the same shall be considered to have failed in that examination.

14. IMPROVEMENT OF MARKS IN THE COURSES ALREADY PASSED

Candidates desirous of improving the marks secured in a passed course in their first attempt shall reappear once (only in ESE) in the subsequent semester. The improved marks shall be considered for classification but not for ranking. If there is no improvement there shall be no change in the marks awarded earlier.

15. 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 in each course as detailed below:

<table>
<thead>
<tr>
<th>Letter grade</th>
<th>Marks Range</th>
<th>Grade Point</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>91 - 100</td>
<td>10</td>
<td>OUTSTANDING</td>
</tr>
<tr>
<td>A+</td>
<td>81- 90</td>
<td>9</td>
<td>EXCELLENT</td>
</tr>
<tr>
<td>A</td>
<td>71-80</td>
<td>8</td>
<td>VERY GOOD</td>
</tr>
<tr>
<td>B+</td>
<td>66- 70</td>
<td>7</td>
<td>GOOD</td>
</tr>
<tr>
<td>B</td>
<td>61 – 65</td>
<td>6</td>
<td>ABOVE AVERAGE</td>
</tr>
<tr>
<td>C</td>
<td>55 - 60</td>
<td>5</td>
<td>AVERAGE</td>
</tr>
<tr>
<td>D</td>
<td>50 - 54</td>
<td>4</td>
<td>PASS</td>
</tr>
<tr>
<td>RA</td>
<td>&lt;50</td>
<td>-</td>
<td>REAPPEARANCE</td>
</tr>
<tr>
<td>AAA</td>
<td>-</td>
<td>-</td>
<td>ABSENT</td>
</tr>
</tbody>
</table>

16. GRADE SHEET

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

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

ii. The Grade Point Average (GPA) for the semester and

iii. The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.
iv. Remark on Extension Activities (only in the 6th Semester Grade Sheet)

GPA of a Semester and CGPA of a programme will be calculated as follows.

\[
\text{GPA of a Semester} = \frac{\sum CiGPi}{\sum Ci}
\]

Sum of the product of the GP by the corresponding credits of the courses offered in that Semester

\[
\text{CGPA of the entire programme} = \frac{\sum \sum CniGPni}{\sum \sum Cni}
\]

Sum of the credits of the courses of the entire programme

where,

- \(Ci\) is the credit fixed for the course ‘i’ in any semester
- \(GPi\) is the grade point obtained for the course ‘i’ in any semester
- ‘n’ refers to the Semester in which such courses are credited.

Note: RA grade will be excluded for calculating GPA and CGPA.

17. REVALUATION

A candidate can apply for revaluation and retotalling of his / her semester examination answer script (theory courses only), within 2 weeks from the declaration of results, on payment of a prescribed fee. For the same, the prescribed application has to be sent to the Controller of Examinations through the HoD. A candidate can apply for revaluation of answer scripts not exceeding 5 courses at a time. The Controller of Examination will arrange for the revaluation and the results will be intimated to the candidate through the concerned HoD. Revaluation is not permitted for supplementary theory courses.
18. TRANSPARENCY AND GRIEVANCE COMMITTEE
Revaluation and Re-totaling is allowed on representation (clause 17). Student may get the Xerox copy of the answer script on payment of prescribed fee, if he / she wishes. The student may represent the grievance, if any, to the Grievance Committee, which consists of Dean of the Faculty, (if Dean is HoD, the Dean of another Faculty nominated by the KAHE), HoD of the Department concerned, the faculty of the course and Dean from other discipline nominated by the KAHE and the CoE. If the Committee feels that the grievance is genuine, the script may be sent for external valuation; the marks awarded by the External examiner will be final. The student has to pay the prescribed fee for the same.

19. ELIGIBILITY FOR THE AWARD OF THE DEGREE
A student shall be declared to be eligible for the conferment of the Degree if he / she has

- Successfully completed all the components prescribed under Parts I to Part IV in the CBCS pattern to earn the minimum required credits as specified in the curriculum corresponding to his / her programme within the stipulated period vide class 2.1.
- No disciplinary action is pending against him / her.
- The award of the degree must be approved by the Board of Management.

20. CLASSIFICATION OF THE DEGREE AWARDED
20.1 Candidate who qualifies for the award of the Degree (vide clause 19) having passed the examination in all the courses in his / her first appearance, within the specified minimum number of semesters and securing a **CGPA not less than 8** shall be declared to have passed the examination in **First Class with Distinction**.

20.2 Candidate who qualifies for the award of the Degree (vide clause 19) having passed the examination in all the courses within the specified maximum number of semesters (vide clause 2.1), securing a **CGPA not less than 6.5** shall be declared to have passed the examination in **First Class**.

20.3 All other candidates (not covered in clauses 20.1 and 20.2) who qualify for the award of the degree (vide Clause 19) shall be declared to have passed the examination in **Second Class**.

21. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION
21.1 Candidate, may for valid reasons and on prior application, be granted permission to withdraw from appearing for the examination of any one
course or consecutive examinations of more than one course in a semester examination.

21.2 Such withdrawal shall be permitted only once during the entire period of study of the degree programme.

21.3 Withdrawal of application is valid only if it is made within 10 days prior to the commencement of the examination in that course or courses and recommended by the HoD / Dean concerned and approved by the Registrar.

21.3.1 Notwithstanding the requirement of mandatory TEN days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

21.4 Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction. This provision is not applicable to those who seek withdrawal during IV semester.

21.5 Withdrawal from the End semester examination is NOT applicable to arrears courses of previous semesters.

21.6 The candidate shall reappear for the withdrawn courses during the examination conducted in the subsequent semester.

22. PROVISION FOR AUTHORISED BREAK OF STUDY

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

22.2 The candidate thus permitted to rejoin the Programme after the break shall be governed by the Curriculum and Regulations in force at the time of rejoining. Such candidates may have to do additional courses as per the Regulations in force at that period of time.

22.3 The authorized break of study (for a maximum of one year) will not be counted for the duration specified for passing all the courses for the purpose of classification. (Vide Clause 20). However, additional break of study granted will be counted for the purpose of classification.
22.4 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 2.1 irrespective of the period of break of study (vide clause 23.3) in order that he/she may be eligible for the award of the degree.

22.5 If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted ‘Break of Study’ or ‘Withdrawal’ (Clause 22 and 23) is not applicable for this case.

23. RANKING
A candidate who qualifies for the UG Degree programme passing all the Examinations in the first attempt, within the minimum period prescribed for the programme of study from Semester I through Semester VI to the programme shall be eligible for ranking. Such ranking will be confined to 10% of the total number of candidates qualified in that particular programme of study subject to a maximum of 10 ranks.

24. SUPPLEMENTARY EXAMINATION
Supplementary Examination will be conducted only for the final semester students within ten days from the date of publication of results for students who have failed in one theory course only. Such students shall apply with prescribed fee to the Controller of Examinations within the stipulated time.

25. DISCIPLINE
25.1. Every student is required to observe disciplined and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the KAHE. The erring students will be referred to the disciplinary committee constituted by the KAHE, to enquire into acts of indiscipline and recommend the KAHE about the disciplinary action to be taken.

25.2. If a student indulges in malpractice in any of the KAHE / Internal Examination he / she shall be liable for punitive action as prescribed by the KAHE from time to time.

26. REVISION OF REGULATION AND CURRICULUM
The KAHE may from time to time revise, amend or change the Regulations, Scheme of Examinations and syllabi if found necessary.
### DEPARTMENT OF BIOTECHNOLOGY
### FACULTY OF ARTS, SCIENCE AND HUMANITIES
### UG PROGRAM (CBCS) – B.Sc., Biotechnology
### (2018–2019 Batch and Onwards)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Name of the course</th>
<th>Objectives and Outcomes</th>
<th>Instruction hours / week</th>
<th>Credit(s)</th>
<th>Marks</th>
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#### SEMESTER - II

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LS: Language course; EN: English course; ECA: Extra Curricular Activities; NCC: National Cadet Corps; NSS: National Social Service; DSE: Discipline Specific Elective
PROGRAMME OUTCOMES (POs)

a) Graduates will acquire in-depth understanding of basic concept, knowledge about biochemistry and cell organelles, their functions for applied field, allied subject and life skills.

b) The students will be able to discuss the metabolic aspects of biomolecules.

c) The Graduates will gain the technical capability of handling, isolating and identifying various organisms from different sources.

d) Understanding and better knowledge of the causes, types and control methods for environmental pollution by the students.

e) The student will be able to discuss the mechanisms associated with gene expression system in prokaryotes and eukaryotes.

f) Understand the role of different types of cells, effectors and effectors mechanisms in immune-technology by the students.

g) Develop skills associated with screening of industrially important strains, various aspects of bioprocess technology and rDNA technology by the graduates.

h) The student will be able to understand the production of enzymes from different sources and enzyme characterization and kinetic actions in living organisms.

i) The student will be able to understand the production of transgenic plants and animals for human and environmental welfare.

j) Understand the basic concepts and modern knowledge of bioinformatics by graduates.

k) Apply the knowledge and skills gained from molecular aspects should be useful in developing new innovations in different life forms by the graduates.

l) The student will be able design, solve the application oriented problem in biotechnological field through project based learning.

PROGRAMME SPECIFIC OUTCOME(s) (PSOs)

To enable the student to emerge as:

m) Proficiency to work on biotechnological concepts and interdisciplinary areas of science and technology towards product and process development for industrial and academic research applications.

n) An expert in Biotechnology and allied fields (medical, microbial, agricultural, environmental, plant and animal) for utilizing the practical skills to address biotechnological challenges.

o) Proficiency to demonstrate entrepreneurial and leadership skills with life-long learning.
PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

To impart the following PEOs to the students of Under-graduates in Biotechnology:

**PEO I**: To obtain detailed information about the fundamentals of Biotechnology, allied subjects and life skills.

**PEO II**: To provide information about the molecular methods which involved in cellular processes of living systems such as microbes to higher order organisms for applied aspects. To address the emerging need for skilled scientific manpower with research ethics involving organisms.

**PEO III**: To impart the basics and current molecular tools in the areas of Molecular Diagnostics, Fermentation Technology, Plant, Animal & Environmental Biotechnology are included to train the students for man power development and also sensitize them to scope for research. The practical subjects will provide information about the careers in the industry and applied research where biological system is employed.

**PEO IV**: To make the graduates of Biotechnology to learn and to adopt in a competitive world of technology update and contribute to all forms of life.

**MAPPING OF PEOs AND POs**

<table>
<thead>
<tr>
<th>PEOs</th>
<th>Programme Outcome (s)</th>
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<tbody>
<tr>
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<td>(a) (b) (c) (d) (e) (f) (g) (h) (i) (j) (k) (l) (m) (n) (o)</td>
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<td>PSO IV</td>
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B.Sc. Biotechnology 2018-2019

18LSU101 4-H,4-C

B.Sc. Biotechnology

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

Marks: Internal: 40 External: 60 Total: 100

End Semester Exam: 3 Hours
Course Objectives:
To train students to acquire proficiency in English by reading different genres of literature and learning grammar.
To provide aesthetic pleasure through literature.

Course Outcomes (CO'S)
Communication skills will get developed.
Genres of literature will give moral values of life.

UNIT - I    :    PROSE
1. Morals in the Indian Context - Francis Nicholas Chelliah
2. How Comic Books help us to relive our Childhood - Benoit Peeters
3. Let's Do What India Needs From Us - Dr. A.P.J. Abdul Kalam

UNIT - II    :    POEM
1. The Stolen Boat - William Wordsworth
2. Telephone Conversation - Wole Soyinka
3. A River - A.K. Ramanujan

UNIT - III   :    SHORT STORIES
1. Rapunzel - Brothers Grimm
2. The Ant and The Grasshopper - W. Somerset Maugham
3. The Nightingale and the Rose - Oscar Wilde.

UNIT - IV: Drama
1. The Merchant of Venice - Act 4-Scene 1
2. The Death Trap - Saki

UNIT - V: Grammar and Composition
GRAMMAR : 1. Tenses
2. Articles
3. Auxiliaries (Primary and Modal)
4. Tag Questions

Composition:
1. Reading to Comprehend
2. Letter Writing
3. Resume Writing
4. General Essay

Prescribed Text: Reminisce, Published by the Department of English, Karpagam Academy of Higher Education.
SUGGESTED READING:
Course Objectives

- This course is designed to provide clear understanding on the underlying principles of structures and functions of biomolecules to the students of the subjects.

Course Outcomes (CO's)

1. The learners will acquire knowledge on the structure and functions relationship of proteins nucleic acid carbohydrates and as well their roll in various biological process.

UNIT-I Introduction to macromolecules:

UNIT-II Carbohydrates and Metabolism:
Carbohydrates: Structure, Function and properties of Monosaccharides, Disaccharides and Polysaccharides. Bacterial cell wall polysaccharides, Glycoprotein’s and their biological functions; Glycolysis: Fate of pyruvate under aerobic and anaerobic conditions. Pentose phosphate pathway and its significance, Gluconeogenesis, Glycogenolysis and glycogen synthesis. TCA cycle.

UNIT-III Enzymes:
Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, groups, metalloenzymes, monomeric & oligomeric enzymes, activation energy and transition state, enzyme activity, specific activity, common features of active sites, Role of: NAD+, NADP+, FMN/FAD, coenzymes A, Thiamine pyrophosphate, Pyridoxal phosphate, lipoic acid, Biotin vitamin B12, Tetrahydrofolate and metallic ions. Photosynthesis – Photosystem I and II.

UNIT-IV Lipids:
Structure and functions –Classification, nomenclature and properties of fatty acids, essential fatty acids. Phospholipids, sphingolipids, glycolipids, cerebrosides, gangliosides, Prostaglandins, Cholesterol. β-oxidation of fatty acids.

UNIT-V Nucleic acids:
Structure and functions: Physical & chemical properties of Nucleic acids, Nucleosides & Nucleotides, purines & pyrimidines, Biologically important nucleotides, Double helical model of DNA structure, A, B & Z – DNA, denaturation and renaturation of DNA.

SUGGESTED READINGS
B.Sc. Biotechnology

SEMESTER - I

18BTU102 CELL BIOLOGY

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

Marks: Internal: 40 External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

- Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
- Students will understand how these cellular components are used to generate and utilize energy in cells.
- Students will understand the cellular components underlying mitotic cell division.
- Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation.

Course Outcomes (CO’s)

1. This paper will enable the students to learn the basics and lay strong foundation in understanding the composition of cells, how cells work is fundamental to living systems.

UNIT-I Cell:

UNIT-II Extracellular Matrix:
Composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, macromolecules, regulation of receptor expression and function. Signal transduction.

UNIT-III Membrane Vacuolar system, cytoskeleton and cell motility:

UNIT-IV Cell organelles:

UNIT-V Cell abnormalities:
Carcinogenesis, agents promoting carcinogenesis, characteristics and molecular basis of cancer.

SUGGESTED READINGS


Course Objectives
The student should know
- The molecular orbital theory, preparation and properties of inorganic compounds.
- Theory of covalent bond, polar effects and stereochemistry of organic compounds.
- About important industrial chemicals like silicones, fuel gases and fertilizers and their impact on environment.
- Elements of photochemistry, chemical kinetics and chromatography.
- About the dyes, chemotherapy and vitamins.

Course Outcomes (CO's)
The student understand
1. The molecular orbital theory, preparation and properties of inorganic compounds.
2. Theory of covalent bond, polar effects and stereochemistry of organic compounds.
3. About important industrial chemicals like silicones, fuel gases and fertilizers and their impact on environment.
4. Elements of photochemistry, chemical kinetics and chromatography.
5. About the dyes, chemotherapy and vitamins.

UNIT-I Chemical Bonding:

UNIT-II Covalent Bond and Stereoisomerism: Covalent Bond:

UNIT-III Industrial Chemistry:

UNIT-IV Elements of Photochemistry, Chemical Kinetics and Chromatography:
UNIT- V Dyes, Chemotherapy and Vitamins: Dyes:
Terms used chromophore, auxochrome, bathachromic shift and hypsochromic shift- classification of dyes- based on chemical structure and application-one example each for azo, triphenylmethane, vat and mordant dyes- preparation.

Chemotherapy: Preparation, uses and mechanism of action sulpha drugs- preparation and uses of prontosil, sulphadiazine and sulphafurazole-structure and uses of pencillins and Chloromycetin.

Vitamins: Diseases caused by the deficiency of vitamins A, B₁, B₂, C and D-sources of these vitamins.

SUGGESTED READINGS

Course Objectives

- To train the students of the subject on handling various experimental methods and techniques in order to analyze the given biological samples from biochemical stand points.

Course Outcomes (CO's)

1. Students of the subject will acquire skills to quantitatively estimate various biomolecules and as well to carry out enzyme kinetics.

Practical

1. Preparation of buffers.
2. Qualitative tests for Carbohydrates, lipids and proteins.
5. Estimation of blood glucose by glucose oxidase method.
6. To study activity of any enzyme under optimum conditions.
7. Determination of - pH optima, temperature optima, Km value, \( V_{\text{max}} \), Effect of inhibitor (Inorganic phosphate) on the enzyme activity.
8. To study the effect of pH, temperature on the activity of salivary amylase enzyme.

SUGGESTED READINGS

B.Sc. Biotechnology

18BTU112  CELL BIOLOGY PRACTICAL

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

Marks: Internal: 40  External: 60  Total: 100

End Semester Exam: 3 Hours

Course Objectives
- To enable students to learn the basics of prokaryotics and eukaryotics cells
- To develop practical biological skills such as staining, sterilization, dialysis etc.
- To prepare students for subsequent biological courses that require an understanding of the physiology of organisms such as cell division, enzyme activity etc.

Course Outcomes (CO's)
1. It will provide an understanding of the unique features of plant cells and animal cell.
2. Gain understanding on the interaction between cells and the environment

Practical
1. Study of Prokaryotic and Eukaryotic cell, Structure.
2. Study the effect of temperature and organic solvents on semi permeable membrane.
3. Demonstration of dialysis.
4. Study of plasmolysis and de-plasmolysis.
5. Cell division in onion root tip.
7. Preparation of Nuclear, Mitochondrial and cytoplasmic fractions.
8. Determination of enzyme activity in organelles using sprouted seed or any other suitable source.

SUGGESTED READINGS

Course Objectives

- To make the student able to identify the elements and the functional groups present in an organic compound.

Course Outcomes (CO’s)
On successful completion of the course the students should have

1. Learnt about the qualitative analysis of organic compounds.
2. Learnt the detection of elements and functional groups present in an organic compound by systematic analysis.

Systematic analysis of an organic compound

- Preliminary tests
- Detection of elements present
- Aromatic or aliphatic
- Saturated or unsaturated
- Nature of the functional group,
- Confirmatory tests— aldehydes, ketones, amines, amides, diamide, carbohydrates, phenols, acids, esters & nitro compounds.

Note: Each student should analyze minimum 6 compounds.

SUGGESTED READINGS

B.Sc. Biotechnology  
2018-2019

18LSU201  

Instruction Hours / week: L: 4 T: 0 P: 0  
Marks: Internal: 40 External: 60 Total: 100

End Semester Exam: 3 Hours

Ar. I:  

1.  

Marks

1.  

2.  

Ar. II:  

Ar. III:  

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore – 641 021
அன்று – IV: கிளைக்கலை (10 மாண்டுப்புத்தவம்)
1. குறித்துட்பாரும் கோட்டை – மாண்டுப்புத்தவம்
2. குறித்து நுட் பால் - ஸ்பேண்
3. நுட்பகாலி - முடியைராண்டுப்புத்தவம்
4. நுட்பகாலி - குடும்பக

அன்று - V: பல்மீனம்பாக்கி (7 மாண்டுப்புத்தவம்)
பல்மீனம்பாக்கி புள்ளிக்கள் (காட்டு, கல்பீர்க், காட்டு, சான்டாக்)
பல்மீனம்பாக்

பல்மீனம்: காட்டர்கர்க்கு டீபி என்பது பல்மீனம் பல்மீனம் காட்டர்கர் டீபி என்பது பல்மீனம்.
Course Objectives

- The objective of this course is to present basic concepts of heredity and various in living organism and be able to articulate connection between the multiple level of organization, molecular mechanism the expression of DNA at individual level and the transmission of DNA across generation at the individual and population level.

Course Outcomes (CO’s)

1. Upon successful completion of this course student should be able to demonstrate the following competencies; an understanding the central theories and methodologies traditional, molecular and population genetics.

UNIT- I Introduction:

UNIT-II Mendelian genetics :
Mendel’s experimental design, monohybrid, di-hybrid and tri hybrid crosses, Law of segregation & Principle of independent assortment. Verification of segregates by test and back crosses, Chromosomal theory of inheritance, Allelic interactions: Concept of dominance, recessiveness, incomplete dominance, co-dominance, semi-dominance, pleiotropy, multiple allele, pseudo-allele, essential and lethal genes, penetrance and expressivity.

UNIT-III Chromosome and genomic organization:

UNIT-IV Chromosome and gene mutations:
Definition and types of mutations, causes of mutations, Ames test for mutagenic agents, screening procedures for isolation of mutants and uses of mutants, variations in chromosomes structure - deletion, duplication, inversion and translocation (reciprocal and Robertsonian). Sex determination, sex linkage, sex linked diseases: Mechanisms of sex determination, Fragile-X-syndrome and chromosome, sex influenced dominance, sex limited gene expression, sex linked inheritance.

UNIT-V Genetic linkage, crossing over and chromosome mapping:
Linkage and Recombination of genes in a chromosome crossing over. Extra chromosomal inheritance: Rules of extra nuclear inheritance, maternal effects, maternal inheritance, cytoplasmic inheritance, organelle heredity, genomic imprinting. Evolution and population genetics: In breeding and out breeding, Hardy Weinberg law (prediction, derivation), allelic and genotype frequencies, changes in allelic frequencies, systems of mating, evolutionary genetics, natural selection.
SUGGESTED READINGS

Course Objectives

- To make the student to be conversant with the extraction of metals, coordination chemistry, preparation, properties uses and structure of naphthalene and heterocyclic compounds.

- To make the student acquire sound knowledge of electrochemistry, biological functions of amino acids and proteins, thermodynamic laws, entropy, enthalpy change and the principles of electroplating.

Course Outcomes (CO's)

1. The students understand the metallurgy of metals and the theories of coordination compounds and the industrial importance of EDTA, haemoglobin and chlorophyll.
2. Understand the concept of aromaticity and preparation of aromatic compounds including heterocyclic compounds.
3. Understand the preparation, classifications and properties of amino acids, proteins and carbohydrates.
4. Understand the concepts of first and second laws of thermodynamics.
5. Understand the fundamentals of electrochemistry.
6. Understand the fundamentals of electrochemistry.

Unit-I Metals and Coordination Chemistry:
**Metals**: General methods of extraction of metals-methods of ore dressing-types of furnaces-reduction methods-electrical methods-types of refining-Van Arkel process-Zone refining. **Coordination Chemistry**: Nomenclature-theories of Werner, Sidgewick and Pauling-chelation and its industrial importance-EDTA-haemoglobin-chlorophyll-applications in qualitative and quantitative analysis.

Unit-II Aromatic Compounds and Heterocyclic Compounds:

Unit-III Amino acids, Proteins and Carbohydrates:
**Amino acids**: Classification, preparation and properties. Peptides-preparation of peptides (Bergmann method only). **Proteins**: Classification, properties, biological functions and structure. **Carbohydrates**: Classification, preparation and properties of glucose and fructose- discussion of open chain and ring structures of glucose and fructose-glucose-fructose interconversion.

Unit-IV Energetics:
Unit-V Electrochemistry:

SUGGESTED READINGS

Course Objectives
- To impart knowledge on classification of microbes, function and biochemical reaction going on inside the microbial cell.

Course Outcomes (CO's)
1. Students will gain rigorous foundation in various methods to cultivate the microbes and maintenance of the microorganism.

UNIT-I Fundamentals, History, Scope and Evolution of Microbiology:
Classification of microorganisms: Microbial taxonomy, criteria used including molecular approaches, Microbial phylogeny and current classification of bacteria.

UNIT-II Microbial Diversity:
Distribution and characterization Prokaryotic and Eukaryotic cells, Morphology and cell structure of major groups of microorganisms eg. Bacteria, Algae, Fungi, Protozoa and Unique features of viruses.

UNIT-III Cultivation and Maintenance of microorganisms:
Nutritional categories of micro-organisms, Media, Types of media, Methods of isolation, Stating and types, Purification and preservation.

UNIT-IV Microbial growth:

UNIT-V Water Microbiology:

SUGGESTED READINGS
18BTU211 GENETICS PRACTICAL

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

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

Course Objectives
- Genetic laboratory course to introduce the students to learn about prokaryotic and eukaryotic genetic system using modern techniques.

Course Outcomes (CO's)
1. This course will provide to this students about the mechanics of experimentation methods of genetics.

Practical
1. Permanent and temporary mount of mitosis.
2. Permanent and temporary mount of meiosis.
3. Mendelian deviations in dihybrid crosses
5. Karyotyping with the help of photographs
6. Pedigree charts of some common characters like blood group, color blindness and PTC tasting.

SUGGESTED READINGS
**Course Objectives**

- The student on successful completion of the course should learn the principles of volumetric analysis and to estimate the compounds by acidimetry, alkalimetry and permanganometry.

**Course Outcomes (CO's)**

1. The student learnt the principles of quantitative analysis of inorganic compounds.
2. Learnt the estimation of sample present in a solution by volumetric analysis.

**Volumetric analysis**

**A. Acidimetry & Alkalimetry**

1. Estimation of sodium carbonate using standard sodium hydroxide.
2. Estimation of sodium hydroxide using standard sodium carbonate.
3. Estimation of sulphuric acid using standard oxalic acid.
4. Estimation of potassium permanganate using standard sodium hydroxide.

**B. Permanganometry**

1. Estimation of ferrous sulphate using standard Mohr’s salt.
2. Estimation of oxalic acid using standard ferrous sulphate.

**SUGGESTED READINGS**

Course Objectives

- This course will make the students to understand the basic principles of microscopy ultra structure of microbes along with staining mechanism and sterilization mechanism.

Course Outcomes (CO’s)

1. After completion of this course students should have outline knowledge on isolation, sub culture and maintenance of microbes.

Practical

1. Preparation of media & sterilization methods
2. Methods of Isolation of bacteria from different sources.
4. Biochemical characterization of isolated microbes.
5. Enumeration of microorganism - total & viable count.

SUGGESTED READINGS

Course Objectives:
- To create the awareness about environmental concern
- To develop an attitude for understanding the environmental issues.
- To motivate for participation in environment protection and improvement.

Course Outcomes (CO's):
1. Students will gain about environmental pollutions, preventive measures.
2. Student will gain information related to societal issues in concern with environment.
3. Students should have out line knowledge on natural resources and effective management of resources.

UNIT-I Environment:
Definition, scope and importance, components, Ecosystem Definition, Classification of ecosystem, Concept, Structure and functions of ecosystem. Energy flow, Food chains and food webs, Ecological succession.

UNIT-II Natural Resources:
Renewable and Non-renewable Resources: Natural resources and associated problems. Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources: Use and over-utilization, exploitation. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. Ill-effects of fire works.

UNIT-III Biodiversity and Its Conservation:

UNIT-IV Environmental Pollution:
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-V Social Issues and the Environment:
SUGGESTED READINGS