DEPARTMENT OF
BIOTECHNOLOGY

Curriculum and Syllabus for
Model III Botany and Biotechnology
(Double Core) Programme
under Credit Semester System
(with effect from 2019 admissions)

St Berchmans College
Founded 1922
AUTONOMOUS | College with Potential for Excellence | Reaccredited by NAAC with A Grade
Affiliated to Mahatma Gandhi University, Kottayam, Kerala
Changanassery, Kottayam, Kerala, India-686101

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Programme Objectives: The syllabus has been formulated with an objective of laying a strong foundation to all essentials of the subjects with sound practical training and exposure to most modern concepts. The content of the syllabus is expected to enable the students to mould themselves as competent individuals in an international pursuit of knowledge.

Programme Outcome: Graduates will have a detailed knowledge in their area of specialization, a working knowledge of modern research tools, a strong appreciation for scientific research in theoretical and experimental areas. Students who complete these programs will be well prepared for careers in the academic and private sectors or further graduate education.

REGULATIONS FOR UNDERGRADUATE (UG) PROGRAMMES UNDER CREDIT SEMESTER SYSTEM (SB-CSS-UG) 2019

1. SHORT TITLE

1.1 These Regulations shall be called St. Berchmans College (Autonomous) Regulations (2019) governing undergraduate programmes under Credit Semester System.

1.2 These Regulations shall come into force with effect from the academic year 2019 - 20 onwards.

2. SCOPE

2.1 The regulation provided herein shall apply to all regular undergraduate programmes, BA/BSc/BCom/BCA, conducted by St. Berchmans College (Autonomous) with effect from the academic year 2019 - 20.

3. DEFINITIONS

3.1 'University' means Mahatma Gandhi University, Kottayam, Kerala.

3.2 'College' means St. Berchmans College (Autonomous).

3.3 There shall be an Academic Committee nominated by the Principal to look after the matters relating to the SB-CSS-UG system.

3.4 'Academic Council' means the Committee consisting of members as provided under section 107 of the University Act 2014, Government of Kerala.

3.5 'Parent Department' means the Department, which offers a particular undergraduate programme.

3.6 'Department Council' means the body of all teachers of a Department in the College.

3.7 'Faculty Mentor' is a teacher nominated by a Department Council to coordinate the continuous evaluation and other academic activities of the undergraduate programme undertaken in the Department.

3.8 'Programme' means a three year programme of study and examinations spread over six semesters, the successful completion of which would lead to the award of a degree.

3.9 'Duration of Programme' means the period of time required for the conduct of the programme. The duration of an undergraduate programme shall be six (6) semesters.

3.10 'Semester' means a term consisting of a minimum 90 working days, inclusive of tutorials, examination days and other academic activities within a period of six months.

3.11 'Course' means a portion of a subject to be taught and evaluated in a semester.

3.12 'Course Teacher' means the teacher who is taking classes on the course.

3.13 'Core Course' means a course in the subject of specialization within a degree programme. It includes a course on environmental studies and human rights.

3.14 'Complementary Course' means a course, which would enrich the study of core courses.

3.15 'Common Course I' means a course that comes under the category of courses for English.

3.16 'Common Course II' means additional language, which can be opted by a student, from among the languages offered by the College.

3.17 The Common Course I and II is compulsory for all students undergoing undergraduate programmes.

3.18 'Open Course' means a course offered by the departments other than the parent department outside the field specialization of the student, which can be opted by a student.

3.19 'Elective Course' means a course, which can be substituted, by equivalent course from the same subject.

3.20 'Vocational Course' means a course that enables the students to enhance their practical skills and ability to pursue a vocation in their subject of specialization.

3.21 'Audit Course' means a course opted by the students, in addition to the compulsory courses, in order to develop their skills and social responsibility.

3.22 'Extra Credit Course' means a course opted by the students, in addition to the compulsory courses, in order to gain additional credit that would boost the performance level and additional skills.

3.23 Extra credit and audit courses shall be completed by working outside the regular teaching hours.

3.24 There will be two categories of extra credit courses, mandatory and optional. If a student fails to complete the mandatory course, he/she shall complete the same within the tenure of the programme.

The details of the extra credit and audit courses are given below:

Semester	Course	Type
I	Course on Basic Life Support System and Disaster Management	Compulsory, audit course, Grades shall be given
I to VI	Value Education	Compulsory, extra credit
	Virtual Lab experiments/MOOC	Optional, extra credit
II & III	Add on Course	Compulsory, extra credit, Grades shall be given
Summer vacation following semester II	50 hours (10 days) Social Awareness Programme	Compulsory, extra credit, Grades shall be given
IV	Internship/Skill Training	Compulsory, audit course, Grades shall be given
V	Finishing School	Compulsory, audit course

3.25 'On the Job Training' means a job training course given to the students to acquaint them with various industrial skills.

3.26 'Project' means a regular project work with stated credits on which the student conducts a project under the supervision of a teacher in the parent department/any appropriate research centre in order to submit a dissertation on the project work as specified.

3.27 'Dissertation' means a minor thesis to be submitted at the end of a research work carried out by each student on a specific area.

3.28 'Plagiarism' is the unreferenced use of other authors' material in dissertations and is a serious academic offence.

3.29 'Seminar' means a lecture expected to train the student in self-study, collection of relevant matter from books and internet resources, editing, document writing, typing and presentation.

3.30 'Improvement Examination' is an examination conducted to improve the performance of a student in the courses of a particular semester as per the exam manual.

3.31 'Supplementary Examination' is an examination conducted for students who fail in the courses of a particular semester as per the exam manual.

3.32 The minimum credits, required for completing an undergraduate programme is one hundred and twenty (120).

3.33 'Credit' (C) of a course is a measure of the weekly unit of work assigned for that course in a semester.

3.34 'Course Credit': One credit of the course is defined as a minimum of one (1) hour lecture/minimum of two (2) hours lab/field work per week for eighteen (18) weeks in a semester. The course will be considered as completed only by conducting the final examination.

3.35 'Grade' means a letter symbol (A, B, C etc.) which indicates the broad level of performance of a student in a course/semester/programme.

3.36 'Grade Point' (GP) is the numerical indicator of the percentage of marks awarded to a student in a course.

3.37 'Credit Point' (CP) of a course is the value obtained by multiplying the grade point (GP) by the credit (C) of the course.

3.38 'Semester Grade Point Average' (SGPA) of a semester is calculated by dividing total credit points obtained by the student in a semester by total credits of that semester and shall be rounded off to two decimal places.

3.39 'Cumulative Grade Point Average' (CGPA) is the value obtained by dividing the sum of credit points in all the courses obtained by the student for the entire programme by the total credits of the whole programme and shall be rounded off to two decimal places.

3.40 'Institution Average' is the value obtained by dividing the sum of the marks obtained by all students in a particular course by the number of students in the respective course.

3.41 'Weighted Average Score' means the score obtained by dividing sum of the products of marks secured and credit of each course by the total credits of that semester/programme and shall be rounded off to two decimal places.

3.42 'Grace Marks' means marks awarded to course/courses as per the choice of the student, in recognition of meritorious achievements of a student in NCC/NSS/sports/arts and cultural activities.

3.43 First, Second, Third, Fourth and Fifth position shall be awarded to students who come in the first five places based on the overall CGPA secured in the programme in the first chance itself.

4. PROGRAMME STRUCTURE

4.1. The programme shall include core courses, vocational courses, complementary courses, common courses, open course and elective courses. There shall be a project/dissertation to be undertaken by all students. The programme will also include assignments, seminars, practical, viva-voce, OJT, field visit, industry visit etc., if they are specified in the curriculum.

4.2. Total credits for a programme is one hundred and twenty (120). The credit distribution for various UG programmes is shown below.

Model III BSc/BCA

i.	Programme duration	6 Semesters
ii.	Total credits required for successful completion of the programme	120
iii.	Minimum credits required from Core + Elective + Project + Complementary courses	109
iv.	Minimum credits required from Common course I	8
v.	Minimum credits required from Open course	3
vi.	Minimum attendance required	75%

4.3. **Project/Dissertation**

All students shall do a project/research work in the area of core course in the sixth semester. The project/ research work shall be done individually or as a group of maximum five (5) students. The projects/research work shall be identified during the fourth semester of the programme with the help of the supervising teacher. The report of the project/research work shall be submitted to the department during sixth semester and shall be produced before the examiners appointed by the College. The project report/dissertation shall be subject to internal and external evaluation followed by a viva-voce/defence.

4.4. **Evaluations**

The evaluation of each course shall contain two parts.

i Internal or In-Semester Assessment (ISA)

ii External or End-Semester Assessment (ESA)

Both ISA and ESA shall be carried out using indirect grading. The ISA:ESA ratio shall be 1:4, for courses with or without practical. There shall be a maximum of eighty (80) marks for external evaluation and twenty (20) marks for internal evaluation.

4.5. **In-semester assessment**

The components of the internal or in-semester assessment and their marks are as below.

Common Courses

There are four components for ISA, which include attendance, assignment/seminar and in-semester examinations. All the components of the internal assessment are mandatory.

Component	Marks
Attendance	2
Assignment/Seminar	5
Class test	5
Model examination	8
Total	**20**

Marks for attendance

% of Attendance	Marks
Above 90	2
75 – 90	1

(Decimals shall be rounded off to the next higher whole number)

Courses other than common courses without practical

Component	Marks
Attendance	2
Viva	4
Assignment/Seminar	4
Class test	4
Model examination	6
Total	**20**

Marks for attendance

% of Attendance	Marks
Above 90	2
75 – 90	1

(Decimals shall be rounded off to the next higher whole number)

Courses other than common courses with practical

Component	Marks
Attendance	2
Viva	3
Assignment/Seminar	2
Class test	3
Model examination	5
Total	**15**

Marks for attendance

% of Attendance	Marks
Above 90	2
75 – 90	1

(Decimals shall be rounded off to the next higher whole number)

Internal assessment of practical courses

The internal assessment of practical courses shall be conducted either annually or in each semester. The components for internal assessment are given below.

Internal assessment of practical courses evaluated in each semester

Component	Marks
Attendance	1
Lab Test	2
Record*	2
Total	**5**

*Marks awarded for Record shall be related to number of experiments/practicals recorded.

Marks for attendance

% of Attendance	Marks
Above 75	1

(Decimals shall be rounded off to the next higher whole number)

Internal assessment of practical courses evaluated annually

Component	Marks
Attendance	2
Lab Test	4
Record*	4
Total	**10**

*Marks awarded for Record shall be related to number of experiments/practicals recorded.

Marks for attendance

% of Attendance	Marks
Above 90	2
75 – 90	1

(Decimals shall be rounded off to the next higher whole number)

4.6. **Assignments**

Assignments shall be submitted for every course in the first four semesters. At least one assignment for each course shall be submitted in each semester.

4.7. **Seminar**

A student shall present a seminar in the fifth and sixth semesters.

4.8. **In-semester examination**

Every student shall undergo at least two in-semester examinations as class test and model examination as internal component for every course.

4.9. To ensure transparency of the evaluation process, the ISA mark awarded to the students in each course in a semester shall be published on the notice board according to the schedule in the academic calendar published by the College. There shall not be any chance for improvement of ISA. The course teacher and the faculty mentor shall maintain the academic record of each student registered for the course which shall be forwarded to the office of the Controller of Examinations through the Head of the Department and a copy shall be kept in the office of the Head of the Department for at least two years for verification.

4.10. A student who has not secured minimum marks in internal examinations can redo the same before the end semester examination of the semester concerned.

4.11. **End-semester assessment**

The end-semester examination in theory and practical courses shall be conducted by the College.

4.12. The end-semester examinations shall be conducted at the end of each semester. There shall be one end-semester examination of three (3) hours duration in each lecture based course.

4.13. The question paper shall be strictly on the basis of model question paper set by Board of Studies.

4.14. A question paper may contain short answer type/annotation, short essay type questions/problems and long essay type questions. Marks for each type of question can vary from programme to programme, but a general pattern may be followed by the Board of Studies.

4.15. End-semester Examination question pattern shall be as given below.

Courses without practical

Section	Total No. of Questions	Questions to be Answered	Marks	Total Marks for the Section
A	12	10	2	20
B	9	6	5	30
C	4	2	15	30
			Maximum	**80**

Courses with practical

Section	Total No. of Questions	Questions to be Answered	Marks	Total Marks for the Section
A	12	10	2	20
B	9	6	4	24
C	4	2	8	16
			Maximum	**60**

4.16. Photocopies of the answer scripts of the external examination shall be made available to the students for scrutiny as per the regulations in the examination manual.

4.17. Practical examination shall be conducted annually or in each semester. The duration and frequency of practical examination shall be decided by the respective Board of Studies.

4.18. Practical examination shall be conducted by one external examiner and one internal examiner.

4.19. The marks for end-semester theory and practical examinations are given below

Course	Marks
Courses without practical	80
Course with practical	60
Practical (assessment in each semester)	20
Practical (odd and even semester combined)	40

4.20. The project report/dissertation shall be subject to internal and external evaluation followed by a viva-voce at the end of the programme. Internal Evaluation is to be done by the supervising teacher and external evaluation by an external evaluation board consisting of an examiner appointed by the Controller of Examinations and the Head of the Department or his nominee. A viva-voce/defence related to the project work shall be conducted by the external evaluation board and students have to attend the viva-voce/defence individually.

Components of Project Evaluation	Marks
Internal Evaluation	20
Dissertation (External)	50
Viva-Voce (External)	30
Total	**100**

4.21. If the student fails in project evaluation, he or she shall submit the project report/dissertation after modifying it on the basis of the recommendations of the examiners.

4.22. For all courses (theory and practical) an indirect grading system based on a seven (7) point scale according to the percentage of marks (ISA + ESA) is used to evaluate the performance of the student in that course. The percentage shall be rounded mathematically to the nearest whole number.

Percentage of Marks	Grade	Performance	Grade Point
95 and above	S	Outstanding	10
85 to below 95	A+	Excellent	9
75 to below 85	A	Very Good	8
65 to below 75	B+	Good	7
55 to below 65	B	Above Average	6
45 to below 55	C	Satisfactory	5
35 to below 45	D	Pass	4
Below 35	F	Failure	0

5. CREDIT POINT AND GRADE POINT AVERAGE

5.1. **Credit Point**

Credit Point (CP) of a course is calculated using the formula

CP = C × GP

where C is the credit and GP is the grade point

5.2. **Semester Grade Point Average**

Semester Grade Point Average (SGPA) is calculated using the formula

SGPA = TCP/TCS

where TCP is the total credit point of all the courses in the semester and TCS is the total credits in the semester

GPA shall be rounded off to two decimal places.

5.3. **Cumulative Grade Point Average**

Cumulative Grade Point Average (CGPA) is calculated using the formula

CGPA = TCP/TC

where TCP is the total credit point of all the courses in the whole programme and TC is the total credit in the whole programme

GPA shall be rounded off to two decimal places.

5.4. **Grade Point Average (GPA)** of different category of courses viz. Common Course I, Common Course II, Complementary Course I, Complementary Course II, Vocational Course, Core Course etc. are calculated using the formula

GPA = TCP/TC

where TCP is the Total Credit Point of a category of course and TC is the total credit of that category of course

Grades for the different courses, semesters, Semester Grade Point Average (SGPA) and grades for overall programme, Cumulative Grade Point Average (CGPA) are given based on the corresponding Grade Point Average (GPA) as shown below:

GPA	Grade	Performance
9.5 and above	S	Outstanding
8.5 to below 9.5	A+	Excellent
7.5 to below 8.5	A	Very Good
6.5 to below 7.5	B+	Good
5.5 to below 6.5	B	Above Average
4.5 to below 5.5	C	Satisfactory
3.5 to below 4.5	D	Pass
Below 3.5	F	Failure

5.5. A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 35% are required for a pass in a course.

5.6. For a pass in a programme, a separate minimum of grade 'D' is required for all the individual courses.

5.7. If a candidate secures F Grade for any one of the courses offered in a semester/programme, only F grade will be awarded for that semester/programme until the student improves this to D grade or above within the permitted period.

5.8. Candidate who secures D grade and above will be eligible for higher studies.

6. SUPPLEMENTARY/IMPROVEMENT EXAMINATION

6.1 There will be supplementary examinations and chance for improvement. Only one chance will be given for improving the marks of a course.

6.2 There shall not be any improvement examination for practical examinations and examinations of the final year.

7. ATTENDANCE

7.1. The minimum requirement of aggregate attendance during a semester for appearing the end semester examination shall be 75%. Condonation of shortage of attendance to a maximum of ten (10) days in a semester subject to a maximum of two times during the whole period of undergraduate programme may be granted by the College. This condonation shall not be counted for internal assessment.

7.2. Benefit of attendance may be granted to students representing the College, University, State or Nation in Sports, NCC, NSS or Cultural or any other officially sponsored activities such as College union/University union activities etc., on production of participation/attendance

certificates, within one week from competent authorities, for the actual number of days participated, subject to a maximum of ten (10) days in a semester, on the specific recommendations of the Faculty Mentor and Head of the Department.

7.3. A student who does not satisfy the requirements of attendance shall not be permitted to appear for the end-semester examinations.

7.4. Those students who are not eligible even with condonation of shortage of attendance shall repeat the course along with the next batch after obtaining readmission.

8. BOARD OF STUDIES AND COURSES

8.1. The Board of Studies concerned shall design all the courses offered in the UG programme. The Board shall design and introduce new courses, modify or re-design existing courses and replace any existing courses with new/modified courses to facilitate better exposure and training for the students.

8.2. The syllabus of a programme shall contain programme objectives and programme outcome.

8.3. The syllabus of a course shall contain the title of the course, course objectives, course outcome, contact hours, the number of credits, reference materials and model questions.

8.4. Each course shall have an alpha numeric code which includes abbreviation of the course in two letters, the semester number, course code and the serial number of the course.

8.5. Every programme conducted under Credit Semester System shall be monitored by the Academic Council.

9. REGISTRATION

9.1. A student who registers his/her name for the external examination for a semester will be eligible for promotion to the next semester.

9.2. A student who has completed the entire curriculum requirement, but could not register for the semester examination can register notionally, for getting eligibility for promotion to the next semester.

9.3. A student may be permitted to complete the programme, on valid reasons, within a period of twelve (12) continuous semesters from the date of commencement of the first semester of the programme.

9.4. The minimum strength of students for open courses is 15 and the maximum is 75 per batch.

9.5. Each student shall register for the open courses in the prescribed registration form in consultation with the faculty mentor during fourth semester. Faculty mentor shall permit registration on the basis of the preferences of the student and availability of seats.

10. ADMISSION

10.1. The admission to all UG programmes shall be as per the rules and regulations of the College/University.

10.2. The eligibility criteria for admission shall be as announced by the College/University from time to time.

10.3. Separate rank lists shall be drawn up for seats under reservation quota as per the existing rules.

10.4. There shall be an academic and examination calendar prepared by the College for the conduct of the programmes.

11. MARK CUM GRADE CARD

11.1. The College under its seal shall issue to the students, a Mark cum Grade Card on completion of each semester, which shall contain the following information.

i. Name of the Student

ii. Register Number

iii. Photo of the student
iv. Degree
v. Programme
vi. Semester and Name of the Examination
vii. Month and Year of Examination
viii. Stream
ix. Course Code, Title and Credits of each course opted in the semester
x. Marks for ISA, ESA, Total Marks (ISA + ESA), Maximum Marks, Letter Grade, Grade Point (GP), Credit Point (CP) and Institution Average in each course opted in the semester
xi. Total Credits, Marks Awarded, Credit Point, SGPA and Letter Grade in the semester
xii. Weighted Average Score
xiii. Result
xiv. Credits/Grade of Extra Credit and Audit Courses

11.2. The final Mark cum Grade Card issued at the end of the final semester shall contain the details of all courses taken during the entire programme including those taken over and above the prescribed minimum credits for obtaining the degree. The final Mark Cum Grade Card shall show the CGPA and the overall letter grade of a student for the entire programme.

11.3. A separate grade card shall be issued at the end of the final semester showing the extra credit and audit courses attended by the student, grade and credits acquired.

12. AWARD OF DEGREE

The successful completion of all courses other than extra credit and audit courses with 'D' grade shall be the minimum requirement for the award of the degree.

13. MONITORING COMMITTEE

There shall be a Monitoring Committee constituted by the Principal to monitor the internal evaluation conducted by the College. The Course Teacher, Faculty Mentor, and the College Coordinator shall keep all the records of the continuous evaluation, for at least a period of two years, for verification.

14. GRIEVANCE REDRESS MECHANISM

14.1. In order to address the grievance of students regarding ISA, a two-level grievance redress mechanism is envisaged.

14.2. A student can approach the upper level only if grievance is not addressed at the lower level.

14.3. Department level: The Principal shall form a Grievance Redress Committee in each Department comprising of course teacher and one senior teacher as members and the Head of the Department as Chairman. The Committee shall address all grievances relating to the internal assessment of the students.

14.4. College level: There shall be a College level Grievance Redress Committee comprising of Faculty Mentor, two senior teachers and two staff council members (one shall be an elected member) and the Principal as Chairman. The Committee shall address all grievances relating to the internal assessment of the students.

15. TRANSITORY PROVISION

Notwithstanding anything contained in these regulations, the Principal shall, for a period of three years from the date of coming into force of these regulations, have the power to provide by order that these regulations shall be applied to any programme with such modifications as may be necessary.

REGULATIONS FOR ADD ON COURSES FOR UNDERGRADUATE PROGRAMMES

1. DEFINITIONS

1.1 'Add On Course General Coordinator' is a senior teacher nominated by the Principal to coordinate and monitor the Add On courses conducted by various departments.

1.2 'Add On Course Coordinator' is a teacher nominated by a Department Council to coordinate the evaluation and other academic activities of the Add On Course undertaken in the Department.

2. COURSE STRUCTURE

2.1 Add On Course shall be completed outside the regular teaching hours of the undergraduate programmes and shall be completed within the first four semesters of the programme.

2.2 The credit will be awarded only if the student get D grade (35% marks) and above.

2.3 A student can earn any number of extra credits according to his/her choice.

2.4 The minimum credits for an Add On Course shall be two (2).

3. EVALUATIONS

The evaluation of each course shall be done internally and contain two parts.

i. Continuous evaluation
ii. Final evaluation

Both continuous evaluation and final evaluation shall be carried out using indirect grading. The marks for continuous evaluation is twenty (20) and that of final evaluation is eighty (80).

Continuous evaluation

The components of the continuous evaluation and their marks are as below.

For all courses without practical

There are two components for continuous evaluation, which include attendance and assignment. All the components of the continuous evaluation are mandatory.

Components	Marks
Attendance	10
Assignment	10
Total	**20**

Marks for attendance

% of Attendance	Marks
90 and above	10
85 - 89	8
80 – 84	6
76 – 79	4
75	2

(Decimals shall be rounded mathematically to the nearest whole number)

For all courses with practical

The components for continuous evaluation of courses with practical are given below.

Components	Marks
Attendance	10
Lab involvement	10
Total	**20**

Marks for attendance

% of Attendance	Marks
90 and above	10
85 - 89	8
80 – 84	6
76 – 79	4
75	2

(Decimals shall be rounded mathematically to the nearest whole number)

Assignments

At least one assignment shall be submitted for each course.

4. **FINAL EVALUATION**

The final evaluation of theory and practical courses shall be conducted by the College/Department. It can be eighty marks written examination or eighty marks project/practical examination or eighty marks written and project/practical examination combined, as decided by the Board of Studies.

4.1 The question paper shall be strictly on the basis of model question paper set by Board of Studies.

4.2 A question paper may contain objective type, short answer type/annotation, short essay type questions/problems and long essay type questions.

4.3 The duration of written examination shall be decided by the respective Board of Studies and the duration of the practical examination shall be decided by the concerned course coordinator.

4.4 Practical examination shall be conducted by one internal examiner.

4.5 For all courses (theory and practical) an indirect grading system based on a seven (7) point scale according to the percentage of marks (ISA + ESA) is used to evaluate the performance of the student in that course. The percentage shall be rounded mathematically to the nearest whole number.

Percentage of Marks	Grade	Performance
95 and above	S	Outstanding
85 to below 95	A+	Excellent
75 to below 85	A	Very Good
65 to below 75	B+	Good
55 to below 65	B	Above Average
45 to below 55	C	Satisfactory
35 to below 45	D	Pass
Below 35	F	Failure

4.6 A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 35% are required for a pass in a course.

5. **ATTENDANCE**

The minimum requirement of aggregate attendance for appearing the final evaluation shall be 75%.

6. **BOARD OF STUDIES AND COURSES**

6.1 The Board of Studies concerned shall design the Add On Course offered by the department. The Board shall design and introduce new Add On Course, modify or redesign existing Add On

Course and replace any existing Add On course with new/modified Add On course to facilitate better exposure and training for the students.

6.2 The syllabus of an Add On course shall also include the title of the course, contact hours, the number of credits, reference materials and question paper pattern.

6.3 Each course shall have an alpha numeric code which includes programme code, abbreviation of the course in two letters, course code and serial number of the course

6.4 The Add On courses conducted under Credit Semester System shall be monitored by the Academic Council.

6.5 For redressing the complaints in connection with the conduct of Add On course, students shall approach the Grievance Redress Committee functioning in the college.

REGULATIONS FOR CERTIFICATE COURSE IN VALUE EDUCATION FOR UNDERGRADUATE PROGRAMMES

Value Education is a compulsory extra credit course for all the students admitted to the undergraduate programmes.

i. **Duration**

The duration of the course shall be three academic years (six semesters) spanning 60 hrs. There shall be minimum 20 hours in an academic year.

ii. **Evaluation**

The evaluation of each course shall contain two parts.

i. Continuous evaluation
ii. Final evaluation

There shall be a maximum of forty (40) marks for external assessment and ten (10) marks for internal assessment.

Continuous Evaluation

Assignment

The students are supposed to submit at least one assignment in every year and five (5) marks will be given for a submitted assignment

Attendance

The minimum requirement of aggregate attendance during a semester for appearing the end final examination shall be 75%.

Marks for attendance

Maximum of five (5) marks will be given for attendance as follows.

% of Attendance	Marks
90 and above	5
85-89	4
80-84	3
76-79	2
75	1

(Decimals shall be rounded off to the next higher whole number)

Final evaluation

The final examination shall be conducted by the course coordinator. The final assessment examination shall be conducted at the end of every year. There shall be an annual written examination of one and a half hours (1½) duration. The question paper shall be strictly on the basis of model question paper set by Expert Committee. A question paper consists of short answer type, short essay type and long essay type questions.

A separate minimum of 30% marks each for internal and external assessment (continuous and final evaluation) and aggregate minimum of 35% are required for a pass in a course.

iii. **Grading**

The total marks of the course shall be one hundred and fifty (150). The grading of the course is as follows:

Percentage of Marks	Grade	Performance
95 and above	S	Outstanding
85 to below 95	A+	Excellent
75 to below 85	A	Very Good
65 to below 75	B+	Good
55 to below 65	B	Above Average
45 to below 55	C	Satisfactory
35 to below 45	D	Pass
Below 35	F	Failure

iv. **Award of certificate**

The course is envisaged with three levels in three academic years. There shall be examination in every year. If a student does not acquire minimum marks he/she can continue with further levels. But he/ she shall be eligible to get certificate only after completing all the levels successfully. The certificate will be issued after completing all the levels with minimum grade D for the pass. On successful completion of the course, grade card shall be issued to the students indicating the grade. The college issues the certificate on value education to all the undergraduate students who successfully complete the course. The course shall be completed during the tenure of the programme.

REGULATIONS FOR COURSE ON BASIC LIFE SUPPORT SYSTEM AND DISASTER MANAGEMENT (BLS & DM)

i. The course on BLS & DM shall be conducted by a nodal centre created in the college.
ii. The nodal centre shall include at least one teacher from each department. A teacher shall be nominated as the Director of BLS & DM.
iii. The team of teachers under BLS & DM shall function as the trainers for BLS & DM.
iv. The team of teachers under BLS & DM shall be given intensive training on Basic Life Support System and Disaster Management and the team shall be equipped with adequate numbers of mannequins and kits for imparting the training to students.
v. Each student shall under go five (5) hours of hands on training in BLS & DM organised by the Centre for BLS & DM.
vi. The training sessions shall be organised on weekends/holidays/vacation during the first semester of the programme.
vii. After the completion of the training, the skills acquired shall be evaluated using an online test and grades shall be awarded.
viii. Nodal centre for BLS & DM shall conduct online test and publish the results.
ix. The grading of the course is as follows:

Percentage of Marks	Grade	Performance
95 and above	S	Outstanding
85 to below 95	A+	Excellent
75 to below 85	A	Very Good
65 to below 75	B+	Good
55 to below 65	B	Above Average
45 to below 55	C	Satisfactory
35 to below 45	D	Pass
Below 35	F	Failure

x. Students who could not complete the requirements of the BLS & DM training shall appear for the same along with the next batch. There shall be two redo opportunity.
xi. For redressing the complaints in connection with the conduct of BLS & DM students shall approach the Grievance Redress Committee functioning in the college.

REGULATIONS FOR SOCIAL AWARENESS PROGRAMME (SAP)

i. Social Awareness Programme shall be conducted by a nodal centre created in the college.

ii. The nodal centre shall include at least one teacher from each department. A teacher shall be nominated as the Director of the SAP.

iii. The centre shall identify the areas where the students can serve the society through the SAP.

iv. During the first semester itself, the centre for SAP shall organise programmes to sensitize the students about the significance and relevance of SAP and publish a list of different areas where they can work as volunteers. Students shall register their preferences (three) with the centre for SAP. The centre shall allot students to various areas based on their preference. For the preparation of the allotment list, the marks obtained in the higher secondary examination shall also be used as a criterion. Centre for SAP shall take the help of the Head of the concerned department and the mentor(s) of the concerned batch at the time of finalization of the allotment list.

v. Students shall carry out the voluntary work allotted to them after the regular class hours/weekends/holidays falling in the second semester or the summer vacation following the second semester.

vi. Evaluation of the SAP activity shall be based on the hours of work put in by a student. A minimum of 50 hours of social work (corresponding to 50 marks) is required for the successful completion of SAP. Every additional work beyond the minimum 50 hours shall fetch five (5) marks per hour. Maximum marks shall be 100. Students who donate blood during the second semester shall be given 10 marks upon the production of the certificate from the medical officer. However, Marks earned through blood donation shall not be counted for a pass in the programme. Mark for blood donation shall be awarded only once during the SAP.

vii. Upon completion of SAP, the marks earned and the grades awarded shall be published by the Director of SAP. The grading is as follows:

Percentage of Marks	Grade	Performance
95 and above	S	Outstanding
85 to below 95	A+	Excellent
75 to below 85	A	Very Good
65 to below 75	B+	Good
55 to below 65	B	Above Average
45 to below 55	C	Satisfactory
35 to below 45	D	Pass
Below 35	F	Failure

viii. Two credits shall be awarded to students who complete the requirements of SAP.

ix. Students who could not complete the requirements of the SAP shall appear for the same with the next batch. There shall be two redo opportunity.

x. For redressing the complaints regarding allotment, harassment at the place of work, and the marks and grades awarded students shall approach the Grievance Redress Committee functioning in the college.

xi. Director of SAP has the right to exclude students who are physically handicapped from SAP.

REGULATIONS FOR INTERNSHIP/SKILL TRAINING PROGRAMME

i. Every UG student shall undergo an internship for a minimum period of five days (25 hours) at a centre identified by the concerned department. In the case of disciplines where internship opportunities are scanty (eg. Mathematics) special skill training programmes with duration of five days (25 hours) shall be organised.

ii. Each department shall identify a teacher in charge for internship/skill training programme.

iii. The department shall select institutions for internship/organising skill training programme.

iv. Internship/skill training programme shall be carried out preferably during the summer vacation following the fourth semester or during the Christmas vacation falling in the fourth semester or holidays falling in the semester.

v. At the end of the stipulated period of internship each student shall produce an internship completion cum attendance certificate and an illustrated report of the training he/she has underwent, duly certified by the tutor and Head of the institution where the internship has been undertaken.

vi. Students undergoing skill training programme shall submit a training completion cum attendance certificate and a report of the training he/she has underwent, duly certified by the trainer, teacher co-ordinator of the programme from the concerned department and the head of the department concerned.

vii. Upon receipt of the internship completion cum attendance certificate and illustrated report of the training or a training completion cum attendance certificate and a report of the training, the teacher in charge of internship/skill training programme shall prepare a list of students who have completed the internship/skill training programme and a list of students who failed to complete the programme. Head of the department shall verify the lists and forward the lists to the Controller of Examinations.

viii. Students who could not complete the requirements of the internship/skill training programme shall appear for the same with the next batch. There shall be only one redo opportunity.

REGULATIONS FOR FINISHING SCHOOL

i. The training to help students develop their soft skills and interview skills, 'The Finishing School', shall be coordinated by a nodal centre.

ii. The nodal centre shall include at least one teacher from each department. A teacher shall be nominated as the Director of the nodal centre.

iii. The training shall impart soft skills comprising of language skills, personal presentation and grooming, resume preparation, group discussion techniques, and interview skills among the undergraduate students.

iv. This course shall be conducted during the fifth semester for all the undergraduate students.

v. There will be a total of 20 contact hours which shall be handled by a team of professional members/faculty. In addition, a one-day outbound training session by a team of professional trainers that touches on the aspects of creativity, problem solving and team building shall also be organized.

vi. The students shall be assessed and grades shall be awarded based on the components as shown below.

Component	Marks
Attendance	5
Class Test	10
Assignments	10
Group discussion	10
Interview	15
Total	**50**

vii. The grading of the course is as follows:

Percentage of Marks	Grade	Performance
95 and above	S	Outstanding
85 to below 95	A+	Excellent
75 to below 85	A	Very Good
65 to below 75	B+	Good
55 to below 65	B	Above Average
45 to below 55	C	Satisfactory
35 to below 45	D	Pass
Below 35	F	Failure

viii. For redressing the complaints in connection with the conduct of finishing school students shall approach the Grievance Redress Committee.

VIRTUAL LAB EXPERIMENTS/MOOC

i. There shall be a Nodal officer and a team of teachers to coordinate the logistics for conducting Virtual Lab experiments and MOOC courses and to authenticate the claims of the students regarding the successful completion of the Virtual Lab experiments and or MOOC courses.

ii. Students who are desirous to do Virtual Lab experiments and or MOOC courses shall register with the Nodal officer at the beginning of the experiment session/MOOC course. Students also shall submit proof of successful completion of the same to the Nodal officer.

iii. Upon receipt of valid proof, the nodal officer shall recommend, to the Controller of Examinations, the award of extra credits. In the case of Virtual Lab experiments, 36 hours of virtual experimentation shall equal one credit and in the case of MOOC courses 18 hours of course work shall equal one credit.

iv. College shall arrange infrastructure for taking up Virtual Lab experiments and/or MOOC courses.

Model Mark cum Grade Card

St Berchmans College
Founded 1922
AUTONOMOUS College with Potential for Excellence | Reaccredited by NAAC with A Grade
Affiliated to Mahatma Gandhi University, Kottayam, Kerala
Changanassery, Kottayam, Kerala, India-686101

MARK CUM GRADE CARD

Date:

Name of the Candidate :

Permanent Register Number (PRN) :

Degree :

Programme :

Stream :

Name of Examination :

Photo

Course Code	Course Title	Credits (C)	Marks						Grade Awarded (G)	Grade Point (GP)	Credit Point (CP)	Institution Average	Result
			ISA		ESA		Total						
			Awarded	Maximum	Awarded	Maximum	Awarded	Maximum					
	Common Course I												
	Core Course												
	Complementary Course												
	Complementary Course												
	Total												
	Weighted Average Score												
	Semester Result												
	SGPA												
	End of Statement												

Entered by:

Verified by:

Controller of Examinations **Principal**

St Berchmans College
Founded 1922
AUTONOMOUS
College with Potential for Excellence | Reaccredited by NAAC with A Grade
Affiliated to Mahatma Gandhi University, Kottayam, Kerala
Changanassery, Kottayam, Kerala, India - 686101, Tel: 91-481-2420025, 9961231314
E-mail: sbc@sbcollege.org Web: www.sbcollege.ac.in

CONSOLIDATED MARK CUM GRADE CARD

Photo

Name of the Candidate :

Permanent Register Number (PRN) :

Degree :

Programme :

Stream :

Date :

Course Code	Course Title	Credits (C)	Marks						Grade Awarded (G)	Grade Point (GP)	Credit Point (CP)	Institution Average	Result
			ISA		ESA		Total						
			Awarded	Maximum	Awarded	Maximum	Awarded	Maximum					
SEMESTER I													
	Common Course I **Core Course** **Complementary Course** **Complementary Course**												

SEMESTER II													
	Common Course I **Core Course** **Complementary Course** **Complementary Course**												
SEMESTER III													
	Core Course **Complementary Course** **Complementary Course**												
SEMESTER IV													
	Core Course **Complementary Course** **Complementary Course**												
SEMESTER V													
	Core Course **Open Course**												
SEMESTER VI													
	Core Course **Project**												

SEMESTER RESULTS

Semester	Marks Awarded	Maximum Marks	Credits	SGPA	Grade	Month & Year of Passing	Result
I II III IV V VI							

PROGRAMME PART RESULTS

Programme Part	Marks Awarded	Maximum Marks	Credits	CGPA	Grade
Common Course I: Core Course: Core Course: Complementary Course: Complementary Course: Open Course:					
Total					

FINAL RESULT

CUMULATIVE GRADE POINT AVERAGE (CGPA) =

GRADE =

*** Separate grade card is issued for Audit and Extra Credit courses.**
**** Grace Mark awarded.**

Entered by:

Verified by:

Controller of Examinations **Principal**

Reverse side of the Mark cum Grade Card (COMMON FOR ALL SEMESTERS)

Description of the Evaluation Process

Grade and Grade Point

The evaluation of each course comprises of internal and external components in the ratio 1:4 for all Courses. Grades and Grade Points are given on a seven (7) point scale based on the percentage of Total Marks (ISA + ESA) as given in Table 1. Decimals are corrected to the nearest whole number.

Credit Point and Grade Point Average

Credit Point (CP) of a course is calculated using the formula

CP = C × GP

where C is the Credit and GP is the Grade Point

Grade Point Average of a Semester (SGPA) or Cumulative Grade Point Average (CGPA) for a Programme is calculated using the formula

SGPA or CGPA = TCP/TC

where TCP is the Total Credit Point for the semester/programme and TC is the Total Credit for the semester/programme GPA shall be rounded off to two decimal places.

The percentage of marks is calculated using the formula;

$$\% \text{ Marks} = \left(\frac{\text{total marks obtained}}{\text{maximum marks}}\right) \times 100$$

Percentage of Marks	Grade	Performance	Grade Point
95 and above	S	Outstanding	10
85 to below 95	A+	Excellent	9
75 to below 85	A	Very Good	8
65 to below 75	B+	Good	7
55 to below 65	B	Above Average	6
45 to below 55	C	Satisfactory	5
35 to below 45	D	Pass	4
Below 35	F	Failure	0

Table 1

Grades for the different Semesters and overall Programme are given based on the corresponding GPA, as shown in Table 2.

GPA	Grade	Performance
9.5 and above	S	Outstanding
8.5 to below 9.5	A+	Excellent
7.5 to below 8.5	A	Very Good
6.5 to below 7.5	B+	Good
5.5 to below 6.5	B	Above Average
4.5 to below 5.5	C	Satisfactory
3.5 to below 4.5	D	Pass
Below 3.5	F	Failure

Table 2

Weighted Average Score (WAS) is the score obtained by dividing sum of the products of marks secured and credit of each course by the total credits of that semester/programme and shall be rounded off to two decimal places.

Note: Course title followed by (P) stands for practical course. A separate minimum of 30% marks each for internal and external assessments (for both theory and practical) and an aggregate minimum of 35% marks is required for a pass in each course. For a pass in a programme, a separate minimum of Grade D for all the individual courses and an overall Grade D or above are mandatory. If a candidate secures Grade F for any one of the courses offered in a Semester/Programme, only Grade F will be awarded for that Semester/Programme until the candidate improves this to Grade D or above within the permitted period.

PROGRAMME STRUCTURE

Semester I

Sl. No.	Course	Hours/ Week	Credit	Marks
1	Common Course I	5	4	100
2	Core Course: Botany	2	2	75
3	Core Course: Botany	2	2	75
4	Core Course: Biotechnology	2	2	75
5	Core Course Practical: Botany	2	1	25
6	Core Course Practical: Botany	2	1	25
7	Core Course Practical: Biotechnology	2	1	25
8	Complementary Course: Biochemistry	2	2	75
9	Complementary Course: Zoology	2	2	75
10	Complementary Course Practical: Biochemistry	2	1	25
11	Complementary Course Practical: Zoology	2	Evaluation in Semester II	
	Total	**25**	**18**	**575**

Semester II

Sl. No.	Course	Hours/ Week	Credit	Marks
1	Common Course I	5	4	100
2	Core Course: Botany	2	2	75
3	Core Course: Biotechnology	2	2	75
4	Core Course: Biotechnology	2	2	75
5	Core Course Practical: Botany	2	1	25
6	Core Course Practical: Biotechnology	2	1	25
7	Core Course Practical: Biotechnology	2	1	25
8	Complementary Course: Biochemistry	2	2	75
9	Complementary Course: Zoology	2	2	75
10	Complementary Course Practical: Biochemistry	2	1	25
11	Complementary Course Practical: Zoology	2	2	50
	Total	**25**	**20**	**625**

Semester III

Sl. No.	Course	Hours/ Week	Credit	Marks
1	Core Course: Botany	3	3	75
2	Core Course: Botany	3	3	75
3	Core Course: Biotechnology	3	3	75
4	Core Course Practical: Botany	2	1	25
5	Core Course Practical: Botany	2	1	25
6	Core Course Practical: Biotechnology	2	1	25
7	Complementary Course: Biochemistry	3	3	75
8	Complementary Course: Zoology	3	3	75
9	Complementary Course Practical: Biochemistry	2	1	25
10	Complementary Course Practical: Zoology	2	Evaluation in Semester IV	
	Total	**25**	**19**	**475**

Semester IV

Sl. No.	Course	Hours/ Week	Credit	Marks
1	Core Course: Botany	3	3	75
2	Core Course: Botany	3	3	75
3	Core Course: Biotechnology	3	3	75
4	Core Course Practical: Botany	2	1	25
5	Core Course Practical: Botany	2	1	25
6	Core Course Practical: Biotechnology	2	1	25
7	Complementary Course: Biochemistry	3	3	75
8	Complementary Course: Zoology	3	3	75
9	Complementary Course Practical: Biochemistry	2	1	25
10	Complementary Course Practical: Zoology	2	2	50
	Total	**25**	**21**	**525**

Semester V

Sl. No.	Course	Hours/ Week	Credit	Marks
1	Core Course: Botany	3	3	75
2	Core Course: Botany	3	3	75
3	Core Course: Botany	3	3	75
4	Core Course: Biotechnology	3	3	75
5	Core Course Practical: Botany	3	1	25
6	Core Course Practical: Botany	2	1	25
7	Core Course Practical: Botany	3	1	25
8	Core Course Practical: Biotechnology	2	1	25
9	Open Course	3	3	100
10	Industrial Visit/OJT/Credit Seminar	-	1	100
	Total	**25**	**20**	**600**

Semester VI

Sl. No.	Course	Hours/ Week	Credit	Marks
1	Core Course: Biotechnology	3	3	75
2	Core Course: Biotechnology	3	3	75
3	Core Course: Biotechnology	3	3	75
4	Core Course: Botany	3	3	75
5	Elective Course	3	3	100
6	Core Course Practical: Biotechnology	3	1	25
7	Core Course Practical: Biotechnology	3	1	25
8	Core Course Practical: Biotechnology	2	1	25
9	Core Course Practical: Botany	2	1	25
10	Project	-	3	100
	Total	**25**	**22**	**600**
	Grand Total	**-**	**120**	**3400**

Botany Core syllabus will be provided by Botany Board of Studies

OUTLINE OF BIOTECHNOLOGY CORE COURSES

Course Code	Course Title	Hours /Week	Total Hours	Credit	ISA	ESA	Total
Semester I							
BBBT101	Cytology	2	36	2	15	60	75
BBBT1P01	Cytology (P)	2	36	1	5	20	25
Semester II							
BBBT202	Plant Cell, Tissue and Organ Culture	2	36	2	15	60	75
BBBT203	Genetics	2	36	2	15	60	75
BBBT2P02	Plant Cell, Tissue and Organ Culture (P)	2	36	1	5	20	25
BBBT2P03	Genetics (P)	2	36	1	5	20	25
Semester III							
BBBT304	Molecular Biology	3	54	3	15	60	75
BBBT3P04	Molecular Biology (P)	2	36	1	5	20	25
Semester IV							
BBBT405	Immunology	3	54	3	15	60	75
BBBT4P05	Immunology (P)	2	36	1	5	20	25
Semester V							
BBBT506	Biophysics and Instrumentation	3	54	3	15	60	75
BBBT5P06	Biophysics and Instrumentation (P)	2	36	1	5	20	25
BBBT5IV	Industrial Visit/OJT/Credit Seminar	-	-	1	100	-	100
Semester VI							
BBBT607	Methods in Molecular Biology and Genetic Engineering	3	54	3	15	60	75
BBBT608	Genomics and Bioinformatics	3	54	3	15	60	75
BBBT609	Industrial and Environmental Biotechnology	3	54	3	15	60	75
	Elective Course	3	54	3	20	80	100
BBBT6P07	Methods in Molecular Biology and Genetic Engineering (P)	3	54	1	5	20	25
BBBT6P08	Genomics and Bioinformatics (P)	3	54	1	5	20	25
BBBT6P09	Industrial and Environmental Biotechnology (P)	2	36	1	5	20	25
BBBT6PJ	Project	-	-	3	20	80	100

ELECTIVE COURSES

Course Code	Course Title	Hours /Week	Total Hours	Credit	ISA	ESA	Total
BBBT6E01	Animal Biotechnology and Nanobiotechnology	54	3	3	20	80	100
BBBT6E02	IPR and Patents	54	3	3	20	80	100
BBBT6E03	Phytochemistry and Pharmacognosy	54	3	3	20	80	100
BBBT6E04	Developmental Biology	54	3	3	20	80	100

SEMESTER I

BBBT101: CYTOLOGY

Total Hours: 36

Credit: 2

Objective: To understand cytological, biochemical, physiological and genetic aspects of the cell and to relate normal cellular structures to their functions.

Outcome: Students will be able to describe the intricate relationship between various cellular structures and their corresponding functions.

Module 1- Cell architecture and membrane structure (3 hours)

Cell Architecture: prokaryotic and eukaryotic cells. Biomembrane structure: The Phospholipid Bilayer: Composition and structural Organization. Membrane Proteins: Structure and Functions, Phospholipids, Sphingolipids, and Cholesterol: Structure and function

Module 2 - Cell structure (7 hours)

The detailed structure of plant cell. Structure and function of the following organelles nucleus, endoplasmic reticulum, plastids, mitochondria, ribosomes, dictyosome, microbodies, lysosomes, vacuole, nucleolus. Differences between animal cell and plant cell

Module 3 – Cytoskeleton (5 hours)

Functions of cytoskeleton; Structure, assembly, disassembly and regulation of filaments involved, actinfilaments (microfilaments), microtubules, and intermediate filaments. Molecular motors; kinesins, dyneins, myosins (5 hours)

Module 4 – Chromosomes (3 hours)

Morphology - fine structure, Nucleosome model, karyotype and idiogram; Special type of chromosomes - salivary gland, Lamp brush and B chromosome.

Module 5 - Transmembrane Transport of Ions and Small Molecules (6 hours)

Overview of Transmembrane Transport , Facilitated Transport of Glucose and Water, ATP Powered Pumps and the Intracellular Ionic Environment, Nongated Ion Channels and the Resting Membrane Potential, Cotransport by Symporters and Antiporters; Transcellular Transport

Module 6 – Cell Cycle and Cell Division (6 hours)

Overview of the Cell Cycle and its Control, Surveillance Mechanisms in Cell Cycle Regulation, Model Organisms and Methods to Study the Cell Cycle, Details of mitosis and meiosis, cell senescence and cell death, programmed cell death; the events of apoptosis, caspases

Module 7 - Cell Signaling (6 hours)

Signaling molecules and their receptors, modes of cell – cell signaling, steroid hormones and their nuclear receptor super family, nitric oxide, carbon monoxide, neurotransmitters, cell surface receptors; G-protein coupled receptors, Intracellular signal transduction pathway; the cAMP pathway.

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3. Becker, W. M. and Klein smith, L. J., (2005), World of the Cell (6th Ed.), Benjamin Cummings.
4. Gupta, P. K. (2003), Cell and Molecular Biology (2nd Ed.), Rastogi Publication, Meerut17
5. Harvey, L., Arnold, B., Lawrence, S., Zipursky, Paul, M., David, B., and James, D(2000), Molecular Cell Biology (4th Ed.), W. H. Freeman, New York
6. Lodish et al. (2004). Molecular Cell Biology (Scientific American Book)
7. Stern, K.R. (2002), Introduction to plant Biology (8th Ed.), McGraw Hill, Boston

PRACTICAL

BBBT1P01: CYTOLOGY

Total Hours: 36

Credit: 1

1. Study of plant cell structure using Onion epidermal peel
2. Isolation of chloroplast
3. Isolation of mitochondira and staining using Janus Green B
4. Barr body analysis in cheek epithelium.
5. Study of the different stages of mitosis using onion root tip squash
6. Study of the different stages of meiosis using permanent slides
7. Study of special type of chromosomes - salivary gland, Lamp brush and B chromosome.

Model Question Paper

ST BERCHMANS COLLEGE CHANGANASSERRY (Autonomous)

B.Sc. Botany & Biotechnology Examination (Model question paper)

First Semester

CYTOLOGY

Time : 3 Hrs **Max Marks: 60**

PART A

(Answer any ten. Each question carries 2 marks)

1. Idiogram
2. Membrane proteins.
3. Synaptonemal complex.
4. Euploidy
5. Lysosomes
6. Cisternae
7. Cyclin and cyclin dependant kinase.
8. Apoplast
9. Zygotene
10. G-protein
11. Symporters and antiporters.
12. Sandwich model. **(10×1=20)**

Part B

(Answer any six. Each question carries 4 marks)

13. Give the ultrastructure of the chloroplast with its major functions.
14. Explain about cell division and its various stages?
15. Comment on features of special chromosomes.
16. What are microtubules?
17. Explain signalling through steroid hormone receptors.
18. Describe various models of plasma membrane and explain which of these models is dynamic.
19. Describe the process of mitosis.
20. Write short account on the Nucleosome model.
21. Briefly explain the importance of caspases in apoptosis. **(6×4=24)**

Part C

(Answer any 2. Each question carries 8 marks)

22. Illustrate and explain the difference between a plant and animal cell with the help of a detailed labelled diagram.

23. Write a detailed note on cell signalling.

24.Describe the structure of the mitochondria.Summarize various schemes for coupling electron transport to ADP phosphorylation.

25. Briefly describe membrane transport. **(8×2=16)**

SEMESTER II

BBBT202: PLANT CELL, TISSUE AND ORGAN CULTURE

Total Hours: 36

Credit: 2

Objective: To acquaint students with Techniques of Plant and Animal Tissue Culture

Outcome: Students will be able to grow, maintain, and propagate specific plant and animal cell types in a sterile environment

Module 1 – History and Basic Concepts (3 hours)

Experiments of Gottlieb Haberlandt, P R White, Gautheret, Nobecourt, Skoog and Steward, Cellular totipotency, *in vitro* differentiation–de differentiation and re-differentiation

Module 2 – Tissue Culture Media (6 hours)

Basic components of tissue culture media, inorganic nutrients, carbon source, vitamins, organic supplements, chelating agents, plant hormones, gelling agents, adsorbents, pH of medium, general methodology of medium preparation with special reference to MS medium

Module 3 – Sterilization Techniques (6 hours)

Sterilization of equipments, glasswares, medium end explant. sterilization using hot air, steam, filter, UV, alcohol and chemicals . Working of hot air oven, autoclave and laminar air flow chamber, layout of a tissue culture lab

Module 4 – Micropropagation (9 hours)

Micropropagation- different methods – axillary bud proliferation, meristem and shoot tip culture, direct and indirect organogenesis, somatic embryogenesis, hardening, transplantation and field evaluation, advantages and disadvantages of micropropagation, somaclonal variation, production of haploids through tissue culture; androgenic methods, gynogenic methods, uses of haploids, cryopreservation of plant cells

Module 5 – Cell suspension Culture and Secondary Metabolite Production (6 hours)

Types of suspension cultures; batch culture, continuous culture, measurement of cell growth, synchronization of cells in suspension culture, single cell culture, Bergmann cell plating technique, production of secondary metabolites, medium composition for secondary metabolite production, cell immobilization, biotransformation

Module 6 – Protoplast Isolation and Fusion (6 hours)

Methods ; mechanical, enzymatic, use of osmoticum, protoplast purification, protoplast viability testing, protoplast culture techniques and medium, somatic hybridization,

spontaneous fusion, induced fusion, selection of hybrids, cybrids, applications of protoplast fusion

References

1. Hammond, J., McGarvey, P., Yusibov, V. (2000) Plant Biotechnology: New Products and Applications, Springer Verlag.
2. S. H. Mantell, J. A. Matthews, R. A. McKee (1985) Principles of plant biotechnology: An introduction to genetic engineering in plants, Blackwell Science Inc.
3. Indra K. Vasil (2012) Cell Culture and Somatic Cell Genetics of Plants, Volume 5: Phytochemicals in Plant Cell Cultures, Academic Press.
4. M K Razdan (2003) An introduction to plant tissue culture, Science publishers.
5. P K Gupta (2005) Elements of biotechnology, Rastogi Publications.
6. Henry RJ (1997) Practical applications of plant molecular biology, Chapman & Hall.
7. H S Chawla HS (2002) Biotechnology in crop improvement, Science Publishers.
8. L.A. Anderson, J. Berlin ,C.A. Lambe, M. Misawa ,J.D. Phillipson, M.F. Roberts, A. Rosevear , F. Sasse, (1985) Plant Cell Culture (Advances in Biochemical Engineering/Biotechnology) Springer.

BBBT203: GENETICS

Total Hours: 36

Credit: 2

Objective: The objective of this subject is to focus on the basic principles of classical and population genetics.

Outcome: This subject enable students uncover major concepts of genetics and make connections among those concepts so as to have a fuller understanding of genetics.

Module 1 - Mendelism and its Extension (18 hours)

Experiment of Mendel with *Pisum sativum*, recessive and dominant traits, alleles, principles of inheritance, incomplete dominance and codominance; Incomplete dominance-flower color in Mirabilis: Interaction of genes- comb pattern in poultry (9:3:3:1): Epistasis- recessive- coat color in mice (9:3:4); dominant epistasis- fruit color in summer squash (12:3:1):complementary genes- flower color in Lathyrus (9:7) ; Multiple alleles- general account:ABO blood group in man; co dominance, inheritance of Rh factor, psuedoalleles;pleotropism, Quantitative characters: polygenic inheritance, continuous variation- kernelcolor in wheat/ear size in maize. Pedigree analysis, Chromosome theory of inheritance.

Module 2 – Linkage (3 hours)

Linkage, crossing over and chromosome mapping, Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Construction of linkage map, Sex Linkage, eye color in Drosophila, Haemophilia in man

Module 3 - Extrachromosomal Inheritance (5 hours)

Extrachromosomal Inheritance**,** Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast; Maternal effects -shell coiling in snail; Infective heredity-Kappa particles in Paramecium.

Module 4 – Sex Determination (3 hours)

Sex determination- sex chromosomes and autosomes- chromosomal basis of sex determination; XX-XY, XX-XO mechanism; sex determination in higher plants (*Melandriumalbum*), Sex Chromosomal Abnormalities in Man - Down's, Klinefelter's and Turner's syndromes

Module 5 – Mutation (4 hours)

Mutations, definition, importance of mutation, types of mutations, gene mutations, types of gene mutations, causes of mutations

Module 6 – **Population Genetics** (3 hours)

Gene pool, Gene frequencies, Genotype frequencies; Hardy Weinberg principle, Evolutionary agents – Selection, Migration, Mutation and Genetic drift

Reference

1. Atherly, A. G., Girton, J. R & Donald, M.C., (1999). The Science of Genetics. Saunders College Publications, Harcourt Brace.
2. Daniel, H. & Jones, E.W. (1998) Genetics, Principles and Analysis (4th Ed.). Jones & Barlett Publication.
3. Griffiths, A. J. F., Miller, J. H., Suzuki, D. T., Lewontin, R. C. & Gelbart, W. M. (2000) An Introduction to Genetic Analysis (7th Ed.), Freeman, New York
4. Robert, H. T. (2002). Principles of Genetics (7th Ed.), Tata McGraw Hill. New Delhi
5. Strickberger, M. W. (1985) Genetics (3rd Ed.), Macmillan Publications, New York
6. Sturtevant, A. H. (1965), History of Genetics, Harper & Row, New York

PRACTICAL

BBBT2P02: PLANT CELL, TISSUE AND ORGAN CULTURE

Total Hours: 36

Credit: 1

1. Preparation of nutrient medium – Murashige and Skoog medium
2. Establishing shoot tip, axillary bud cultures
3. Establishing single cell culture of any one plant and preparing a growth curve
4. Immobilization of whole cells or tissues in sodium alginate.
5. Determination of appropriate flower bud containing uninucleate pollen for anther culture using cytological techniques
6. Establishment of the axenic culture of any one crop plant
7. Micropropagation of an orchid variety from immature seeds
8. Production of somatic embryos from one plant
9. Visit a well equipped biotechnology lab and submit a report along with the practical record.

BBBT2P03: GENETICS

Total Hours: 36

Credit: 1

1. Work out problems in:
    a. Monohybrid, dihybrid and back crosses.
    b. All types of modified Mendelian ratios mentioned in the syllabus.
    c. Multiple alleles and their inheritance
    c. Sex linked inheritance
    d. Population genetics (Mendelian traits with typical dominant and recessive relations only)
2. Raise a population of Drosophila and List the contrasting features among the individuals in the Drosophila population
3. Study of normal human karyotype and differentiating it with the karyotypes of Down's, Klinefelter's and Turner's syndromes

Model Question Paper

ST BERCHMANS COLLEGE CHANGANASSERRY (Autonomous)

B.Sc. Botany & Biotechnology Examination (Model question paper)

Fifth Semester

Plant Cell, Tissue and Organ Culture

Time : 3 Hrs **Max Marks: 60**

PART A

(Answer any ten. Each question carries 2 marks)

1. Hardening
2. MS medium
3. What are chelating agents? Give an example.
4. Cellular totipotency.
5. Name two synthetic auxin.
6. Organogenesis.
7. Inoculation
8. Virus indexing
9. Surface sterilisation
10. Micropropagartion
11. Habituation of callus culture
12. Embryo rescue **(10×2=20)**

Part B

(Answer any six. Each question carries 4 marks)

13. What are the uses of haploids?
14. What is filter sterilization? Mention its importance in tissue culture.
15. What is somaclonal variation? Mention its use in crop improvement programme.
16. Discuss briefly about biotransformation.
17. Describe the experiments done by Gottlieb Haberlandt , Gautheret and Skoog.
18. Write notes on Bergmann's cell plating technique
19. What are cybrids? Describe the use of cybrids in crop improvement programme.
20. Explain the production of secondary metabolites in cultures.
21. Describe about synchronization of suspension cultures **(6×4=24)**

Part C

(Answer any 2. Each question carries 8 marks)

22. Describe the procedure of plant protoplast culture.

23. What is micropropagation? Mention its advantages and disadvantages.

24. What is somatic embryogenesis? Write its application.

25. Describe briefly about Plant Growth Regulators. **(8×2=16)**

ST.BERCHMANS COLLEGE (AUTONOMOUS), CHANGANASSERRY

BSc Botany & Biotechnology (Model Question Paper)

II SEMESTER

GENETICS

Time: 3 Hrs Total marks: 60

Part A

(Answer any 10. Each question carries 2 marks)

1. What is pleiotropism?
2. What is gene mapping?
3. Define multiple alleles
4. What is pure line?
5. Differentiate sex chromosomes and autosomes
6. What is the significance of linkage?
7. What are pseudoalleles?
8. Define polygenic inheritance. Give an example
9. What is recombination frequency?
10. Define interference.
11. What genotype is present most often among the progeny (F2) of a dihybrid cross (*AaBb X AaBb*)?
12. Differentiate between gene pool and gene frequency. (2X10=20)

Part B

(Answer any 6. Each question carries 4 marks)

13. Discuss Hardy Weinberg law and mention its applications.
14. What is a pedigree? Give an account on the various symbols used in the pedigree analysis.
15. Give an account on epistasis .Examples
16. Explain Chromosome theory of inheritance
17. Explain two factor and three factor crosses.
18. Explain sex determination in higher plants.
19. Define evolutionary agents and explain different evolutionary agents.
20. Mendel selected *Pisum sativum* as the experimental material for conducting hybridization experiments. Mention its advantages.
21. Define crossing over and types of crossing over. Write the significance of crossing over. (4X6=24)

Part C

(Answer any 2. Each question carries 8 marks)

22. Explain

(a) Define epistasis.

(b) Explain types of epistasis.

(c) Explain one example for dominant epistasis.

23. Bateson crossed two different varieties of white flowered plants. He observed that the F1 progeny were all red flowered and the F2 progeny include red and white flowered in 9:7 ratio. Explain and substantiate your answer.

24. Define Mutation. Discuss in detail the importance, causes and types of mutations.

25. Describe with the help of suitable examples
    a. Infective heredity
    b. Inheritance of Rh factor
    c. Continuous and discontinuous variation
    d. Chromosomal basis of sex determination

(2X8=16)

SEMESTER III

BBBT304: MOLECULAR BIOLOGY

Total Hours: 54

Credit: 3

Objectives: This paper aims to provide students with an in depth understanding of the basic concepts of molecular biology. The structural and functional aspects of basic biomolecules such as DNA, RNA and protein and the mechanisms of DNA replication, transcription, translation and gene regulation will be dealt with. The course facilitates the students to have a strong understanding of the molecular basis of life and the underlying genetic principles

Outcome: The main outcome of this paper is that the student will have the basic in depth knowledge about the macromolecules that store, transmit and execute the genetic information in a living system and the molecular mechanism of the information flow in the living system. This theoretical knowledge on molecular biology will help the students to learn basics of the genetic engineering and rDNA technology work, which makes the basis of modern biotechnological research and industry

Module 1 - Genetic Material (10 hours)

Introduction to heredity and the genetic material, characteristics of genetic material, Early studies on DNA [works of F.Miescher and Erwin Chargaff], The discovery of transforming principle [Griffith's experiment], Identification of the transforming principle [Avery, MacLeod and McCarty's experiment]; [Hershey and Chase experiment],Watson and Crick's discovery of the structure of DNA, discovery of RNA as the genetic material in some organisms [Heinz Fraenkal-Conrat's experiment]. Structure of DNA double helix, different secondary structures [A,B and Z]

Module 2 - DNA Repair and Mutation (6 hours)

DNA repair, mismatch repair, direct repair, base excision repair, nucleotide excision repair, photoreactivation, SOS response. Mutation- definition and Types

Module 3 - DNA Replication (8 hours)

Suspected forms of DNA replication, conservative, dispersive and semi-conservative, Meselson and Stahl's experiment, Requirements for replication; template, raw materials, enzymes and other proteins, direction of replication, mechanism of replication, Bacterial DNA replications, eukaryotic DNA replication, DNA replication inhibitors

Module 4 - Transcription (8 hours)

Transcription, concept of gene, types of RNAs and their function, the template and non template strands of DNA, Promoters; bacterial and eukaryotic, RNA polymerase; bacterial and eukaryotic, the process of bacterial transcription, the process of eukaryotic transcription, RNA processing; addition of 5' cap and 3'polyA tail, split genes, exons, introns, RNA splicing, transcription inhibitors

Module 5 – **Translation** (6 hours)

Structure of tRNA, clover leaf and 'inverted L' models of tRNA, the genetic code, characteristics of the code, process of translation, polyribosomes, mRNA survilience; nonsense mediated mRNA decay, non-stop mRNA decay, stalled ribosome, translation inhibitors

Module 6 – **Gene Regulation** (10 hours)

Levels of gene regulation, gene regulation in bacterial cells; operon concept, negative and positive control, inducible and repressible operons, *lac* operon of *E.coli*, *trp* operon of *E.coli.* Gene regulations in eukaryotes; chromatin remodelling, histone acetylation, DNA methylation, alternative splicing of mRNA, RNA silencing, Si RNA, mi RNA. Transcriptional Control by hormones, Regulation mediated through transcription factors, Regulation of enhancer activity. Epigenetics.

Module 7 – **Molecular biology of cancer** (6 hours)

What is cancer? Is cancer contagious? Tumor viruses, genes that cause cancer, regulation of cell growth, genes that prevent cancer: tumor suppressors, the cell cycle, pRb and p53

Reference

1. Cooper GM and Hausman (2013), The Cell, a molecular approach, 6th Edition, Sinauer Associates, Sunderland
2. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P., (2002), Molecular Biology of the Cell (4th Ed.), Garland Science, New York.
3. Becker, W. M. and Klein smith, L. J., (2005), World of the Cell (6th Ed.), Benjamin Cummings.
4. Gupta, P. K. (2003), Cell and Molecular Biology (2nd Ed.), Rastogi Publication, Meerut
5. Harvey, L., Arnold, B., Lawrence, S., Zipursky, Paul, M., David, B., and James, D(2000), Molecular Cell Biology (4th Ed.), W. H. Freeman, New York
6. Lodish (2016). Molecular Cell Biology, 8th Edition W.H. Freeman
7. Weinberg, Robert A. (2007) The Biology of Cancer. New York: Garland Science

PRACTICAL

BBBT3P04: MOLECULAR BIOLOGY

Total Hours: 36

Credit: 1

1. Work out problems based on DNA structure , replication, transcription and translation
2. Isolation of DNA from plant tissue
3. Agarose Gel Electrophoresis of DNA
4. Spectrophotometric quantification of DNA

Model Question Paper

ST.BERCHMANS COLLEGE (AUTONOMOUS), CHANGANASSERRY

BSc Botany & Biotechnology (Model Question Paper)

SEMESTER IV

MOLECULAR BIOLOGY

Time: 3 Hrs **Total marks: 60**

Part A

(Answerany 10 questions. Each question carries 2 marks)

1. What are the nitrogenous basepairs present in DNA?
2. Define Nucleotide
3. What is Nucleoside?
4. What is Phosphodiester bond?
5. What are DNA replication inhibitors?
6. What are the functions of DNA Polymerase?
7. RNA splicing
8. mRNA surveillance
9. DNA methylation
10. Oncogenes
11. Histones
12. Non sense mediated mRNA decay

(2X10=20)

Part B

(Answer any 6. Each question carries 4 marks)

13. Explain the difference between A and Z DNA
14. Write note on Meselson and Stahl's experiment
15. Explain Heinz Fraenkal- Conrat's Experiment.
16. Explain Photoreactivation method of DNA repair
17. Explain any four properties of genetic code
18. Distinguish between promoters and enhancers
19. Differentiate between structural and regulatory genes
20. Explain gene regulation in eukaryotes
21. Structure of tRNA

(4X6=24)

Part C

(Answer any 2. Each question carries 8 marks)

22. Explain the different DNA repair mechanisms.
23. Explain the Process of Eukaryotic DNA Replication
24. Explain mechanism of translation in prokaryotes
25. Explain mechanism of gene regulation in Prokaryotes with suitable examples (8X2=16)

SEMESTER IV

BBBT405: IMMUNOLOGY

Total Hours: 54

Credit: 3

Objective: To make students understand the basic concepts of immune system and the immunological techniques.

Outcome: The outcome of the subject is the basic understanding of Immunology and immunological techniques.

Module 1 - Introduction (6 hours)

Introduction to immunology, Types of immunity. Innate and acquired, passive, active, Mechanisms of innate immunity (eg. Barriers, phagocytosis, inflammation), Types of infections.

Module 2 - Cells of the Immune System (7 hours)

Leucocytes, lymphocytes and differentiation of lymphocytes, T&B cells, Macrophages, Primary and Secondary lymphoid organs, Complement system and biological effect of complements

Module 3 - Antigens and Antibodies (7 hours)

Antigens and Antibodies, Antigenicity and immunogenicity, Types of antigens, haptens, antigenic determinants, antigen presentation, Basic structure of immunoglobulins, Different classes of immunoglobuins and functions

Module 4 - Antigen Antibody Reactions (8 hours)

Antigen Antibody reactions, Agglutination test, Precipitation test, Clinical applications of antigen antibody reaction, Complement fixation test, Coombs test, Radioimmuno assay, HIV test, direct ELISA, indirect ELISA, competitive ELISA, sandwich ELISA, Immunodiffusion, Immunoflourescence, immunoelectrophoresis.

Module 5 - Humoral and Cell Mediated Immune Response (9 hours)

Humoral and cell mediated immune response, Receptors on T and B cells, MHC, Antibody production, Monoclonal antibodies, Hybridoma technology

Module 6 - Immune Disorders (5 hours)

Immune Disorders, Hypersenstivity, Autoimmunity, Immunodeficiency and AIDS

Module 7 – Vaccines (5 hours)

Vaccines- Major types of vaccines (BCG, DPT, Polio vaccine and TAB Vaccines). Recent trends in vaccine preparation

Module 8 (7 hours**)**

Immunology of Organ and tissue transplantation, Immunology of malignancy, immunotherapy of cancer, ABO and Rh blood group system, immunology of blood transfusion.

Reference

1. R. Ananthanarayanan and C K Jayaram Panicker (2008) Text book of Microbiology Second Edition. Orient Longman
2. Michael J. Pelczar ECS, Chan & Noel .R. Kreig (1996) Microbiology 5th edition, Tata McGraw Hill.
3. Park, K., Parks (2002) Text Book of Preventive and Social Medicine, 17th Edition. Banarasidass Bhenot Publications
4. Panicker, S. Francis .G, and Abraham G.K. (2008) Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala
5. Ivan Roitt,(2002)*Essential Immunology 13th Edition* Wiley Blackwell
6. Sobha & Sharma (2008) Essentials of Modern Biology Ones Student edition

PRACTICAL

BBBT4P05: IMMUNOLOGY

Total Hours: 36

Credit: 1

1. Immunodiffusion in gel
2. Haemagglutination test and identification of blood groups A,B,AB and O, Rh factor
3. Preparation of human blood smear and identification of leucocytes
4. Widal
5. VDRL
6. Rocket immunoelectrophoresis

Model Question Paper

ST.BERCHMANS COLLEGE (AUTONOMOUS), CHANGANASSERRY

BSc Botany & Biotechnology (Model Question Paper)

IV SEMESTER

IMMUNOLOGY

Time: 3 Hrs **Total marks: 60**

Part A

(Answer any 10 questions. Each question carries 2 marks)

1. What is Immunodifussion?
2. Define Active Immunity
3. What is Infection?
4. Define AIDS?
5. What are APC?
6. What is Epitope?
7. Define Complement Fixation?
8. What is Primary Immunodeficiency Diseases?
9. What is MHC?
10. Erythroblastosis fetalis?
11. What is meant by humoral immunity?
12. Oncogenes (10X2=20)

Part B

(Answer any 6. Each question carries 4 marks)

13. Explain the process of Phagocytosis and the importance of Macrophages
14. Comment on AIDS
15. Explain the Mechanism of Innate Immunity
16. What are the types of ELISA test?
17. Explain Type I Hypersensitivity?
18. Explain the structure of Immunoglobulin.
19. Describe Hybridoma technology and describe clinical and industrial applications of Monoclonal antibodies
20. Define transplantation? Describe mechanismS involved in graft rejection
21. Write an essay on various autoimmune diseases. (6X4=24)

Part C

(Answer any 2. Each question carries 8 marks)

22. Explain the different cells of Immune system

23. Write note on primary and secondary organs of Immune system

24. Comment on Complement system and pathway involved

25. Describe different types of Hypersensitivity reactions (2X8=16)

SEMESTER V

BBBT506: BIOPHYSICS AND INSTRUMENTATION

Total Hours: 54

Credit: 3

Objective: Enable the students in understanding the various physico-Chemical techniques and its applications in the analysis of biomolecules.

Outcome: Students gains knowledge about the Principle and working of various techniques and its practical exposure.

Module 1 - Structure, Thermodynamics and Bioenergetics (8 hours)

Laws of thermodynamics, concept of free energy, unavailable energy, entropy, Energy generation and energy transfer processes in biochemical reactions. high energy compounds in biological system, ATP and phosphoryl group transfers, structure and bioenergetics of mitochondria and chloroplast

Module 2 – Membrane Transport (8 hours)

Passive transport; diffusion, Fick's law. diffusion in two compartment & multi compartment systems, mechanisms of simple diffusion & facilitated diffusion, osmosis, osmotic pressure, osmotic equilibrium, molecular basis of aqueous channels. Active transport; Nature, Selective permeability of biomembrane, ion channel structure and gating function, Ion channel types and characterization, Role of carriers in ion transport, Transporting ATPase-Na-K ATPase.

Module 3 – Hydrodynamic Techniques (8 hours)

Centrifugation basic principles, forces involved, RCF, types and applications, ultracentrifugation, instrument design, applications of preparative [Differential, Density Gradient] and analytical [sedimentation velocity, sedimentation equilibrium] ultracentrifugation. viscometry; general features of fluid flow(streamlined and turbulent) nature of viscous drag for streamlined motion, definition of viscosity coefficient, determination of viscosity coefficient of liquids, viscometric measurement, surface tension ; definition, determination of surface tension.

Module 4 - Physicochemical Fractionation & Electro-analytical Techniques (11 hours)

Chromatography-basic concepts of adsorption and partition chromatography, principle methodology and applications of paper, thin layer, column (gel filtration, ion exchange, affinity), gas (GC,GLC) and HPLC chromatography, electrophoresis - principle, instrument

design, methodology and applications of AGE , Pulsed-field AGE, PAGE, SDS-PAGE, capillary electrophoresis, isoelectric focusing, 2D electrophoresis

Module 5 – Spectroscopy (12 hours)

Basic principles, nature of electromagnetic radiation, interaction of light with matter, absorption and emission of radiation; atomic and molecular energy levels, atomic and molecular spectra.

Principle, instrument Design and applications of UV–Visible spectroscopy, IR and Raman spectroscopy, fluorescence spectroscopy, NMR spectroscopy, Atomic absorption spectroscopy, Atomic emission spectroscopy.

Module 6 - Optical and Diffraction Techniques (7 hours)

Principle, instrument design and applications of polarimetry, refractometry, atomic force microscopy.

Circular dichroism (CD) and optical rotatory dispersion (ORD), crystallography; X ray Crystallography, Bragg's Law& Bragg's diffraction equation

Reference

1. Arthur Beisen, (1968) Perspective of Modern Physics-Second Edition. Mc Graw Hill
2. Patel S.B,(1991) Nuclear Physics: an introduction: New Age International
3. White H,E.,(1934)Introduction to Atomic Spectra:, Mc Graw Hill
4. Khandelwal P,P., (1988)Text Book of optics and atomic physics, Himalaya publications
5. Lodish, Berk, Matsudora, Kaiser, Kriegen, (2007) Molecular Cell Biology: WH Freeman and Co.
6. Cotrell, (2003) Biophysics, Eastern Economy Edition.
7. Narayanan P, (2007) Clinical Biophysics: Principles and Techniques, Bhalani Publishers.
8. Pattabhi and Gautham, (2002), Biophysics, Springer science and Business media.

PRACTICAL

BBBT5P06: BIOPHYSICS AND INSTRUMENTATION

Total Hours: 36

Credit: 1

1. Spectral properties (Colorimetric or UV/Visible Spectral analysis of colouring pigments- Beta cyanin, Anthocyanin, Xanthine, Lycopene, Curcumin, capsicin)
2. Separation Techniques: Chromatography (PC, TLC and Column), GC & HPLC , HPTLC (Demonstration only)
3. Electrophoretic separation of protein.

Model Question Paper

ST. BERCHMANS COLLEGE (AUTONOMOUS), CHANGANASSERRY

BSc Botany & Biotechnology (Model Question Paper)

V SEMESTER

BIOPHYSICS AND INSTRUMENTATION

Time: 3 Hrs **Total marks: 60**

Part A

(Answer any 10 questions. Each question carries 2 marks)

1. What is Stationary phase?
2. Define RCF
3. What is Absorption chromatography
4. Define Emission Spectrum?
5. Define Bragg's Law and Equation?
6. What is the use of Refractometry?
7. Define ORD?
8. Difference between Free energy and Unavailable energy
9. What is Osmosis?
10. Define Fick's Law of Diffusion?
11. What is Aqueous channel?
12. What are high energy compounds, Give Eg? (10X2=20)

Part B

(Answer any 6. Each question carries 4 marks)

13. Explain the structure and bioenergetics of Mitochondria
14. Write note on Diffusion and its Biological importance
15. Write note on Viscometry
16. What is Surface Tension, what are the different methods used to determine Surface tension?
17. What is Isoelectric point?
18. Explain the principle of SDS- PAGE
19. Explain Electromagnetic Spectrum
20. Comment on Raman Spectroscopy
21. Explain the principle and use of Polarimetry (4X6=24)

Part C

(Answer any 2. Each question carries 8 marks)

22. Explain the Principle, Procedure and Applications of UV- Visible Spectrophotometry
23. Explain the Principle and procedure of HPLC
24. Comment on the Principle and different types of Centrifugation
25. Write a note on NMR Spectroscopy (8X2=16)

SEMESTER VI

BBBT607: METHODS IN MOLECULAR BIOLOGY AND GENETIC ENGINEERING

Total Hours: 54

Credit: 3

Objective: To familiarize the student with the basic concepts in genetic engineering

Outcome: The student will have enough background of recombinant DNA technology essential for understanding new developments in this field

Module 1 - Methods in Molecular Biology (24 hours)

Nucleic acid isolation, chemistry and procedure. Agarose gel electrophoresis and visualization of the nucleic acid bands.

Blotting techniques; Southern, Northern and Western blotting and hybridization, Probe preparation via nick translation, random priming, end labeling, radioactive and non radioactive probes.

DNA sequencing; Sanger's dideoxy method, working of automated DNA sequencer, pyrosequencing Polymerase chain reaction; An Overview ,Components and Conditions for PCR Optimization, Primer Design, Symmetric PCR , Asymmetric PCR ,Inverse PCR, Anchored PCR, Quantitative real time PCR, SYBR Green and TaqMan chemistries, Applications of PCR,RAPD, RFLP, AFLP, DNA finger printing DNA foot printing

Module 2 - Enzymes Used in Genetic Engineering (6 hours)

Restriction enzymes ,types, properties, nomenclature; DNA methylation systems in *E.coli* (dam, dcm, M *EcoKI*); Phosphatase, polynucleotide kinase, single strand specific nucleases; DNA polymerases (DNA Polymerase I,Klenow fragment, T4DNA Polymerase, T7 DNA Polymerase); RNA Polymerases(T3, T7, SP6); Reverse Transcriptase (AMV, MoMLV), Ligases (T4 DNA ligase, E.coli DNA ligase), TOPO cloning (Vaccinia topoisomerase I), Taq polymerase

Module 3 - Cloning Vectors (18 hours)

Cloning vectors for *E.coli* .Biology of plasmids (conjugative, nonconjugative, relaxed and stringent control of copy number) Plasmid based vectors, pBR 321, pUC series, Biology of Lambda phage (lytic and lysogenic cycle), λ bacteriophage based vectors (insertional and replacement),in vitro packaging; Biology of M13 bacteriophage,M13 phage based vectors,

phagemids, High capacity vectors: cosmids, P1 phage based vectors, bacterial artificial chromosomes. Advantages of each vector. Bacmid ,Cloning vectors for *eukaryotes* *Agrobacterium tumefaciens* and the biology of crown gall formation, Agrobacterium Tiplasmid based vectors, yeast artificial chromosomes, PACs, pcDNA

Module 4 - Covalent Linkage of DNA Fragments to Vector Molecules (1 hour)

Linkers, adapters, homopolymer tailing,

Module 5 - Generation of Genomic and cDNA Libraries (2 hour)

Genomic library, definition and procedure of construction, cDNA library, definition, advantages and procedure of construction, different methods of first strand and second strand of cDNA synthesis

Module 6 - Selection and Screening of Recombinant Clones (3 hours)

Insertional inactivation, alpha complementation and blue white selection, colony and plaque hybridization, immunological screening

References

1. JD Watson(1992), Recombinant DNA Scientific American Books
2. JD Watson et al. (2006) Recombinant DNA: genes and genomes – a short course, WH Freeman & Co.
3. Alex Prokop et al (1997) Recombinant DNA technology and applications,., McGraw Hill
4. R.W. Old and S.B. Primrose, (2001)Principles of Gene Manipulation: An Introduction to Genetic Engineering, by, Blackwell Scientific
5. Sambrook J, Russel DW & Maniatis T. (2001) Molecular Cloning: a Laboratory Manual., Cold Spring Harbour Laboratory Press

BBBT608: GENOMICS AND BIOINFORMATICS

Total Hours: 54

Credit: 3

Objective: To provide basic understanding of how biological data is stored and retrieved from various biological databases and to develop an understanding of algorithms of sequence alignment (pair-wise and multiple) and prediction algorithms.

Outcome: On the completion of this course, students will be able to describe the contents and properties of the most important bioinformatics databases, perform text- and sequence-based searches, and analyze the results in light of molecular biological knowledge.

Genomics

Module 1 – Genomics Introduction (1 hour)

Genomics - Definition, Functional genomics, Structural genomics, Applications of genomic studies

Module 2 – Genome Sequencing **(**3 hours)

Overview: Genomes of Bacteria, Archaea, and Eucarya; Chromatin, supercoiling and packaging; Genome sequencing approaches, Major findings of the following genome projects a)Human b) *Arabidopsis thaliana c)Drosophila melanogaster d)Caenorhabditis elegans e)Mus musculus*

Bioinformatics

Module 1 – Bioinformatics Introduction (1 hour)

An introduction to bioinformatics. Scope and relevance of bioinformatics. Elementary commands and Protocols, ftp, telnet, http. Formats: FASTA format, ASN.1 format, PDB flat file format, mmCIF format, Data mining. Use of PERL in bioinformatics. Application of Bio Edit.

Module 2 – Biological Databases (20 hours)

Online databases and search tools, data organization, NCBI .Biological databases, structural databases, DNA and RNA sequence databases.

Nucleic acid sequence databases: GenBank, EMBL, DDBJ

Protein sequence databases: SWISS-PROT

Protein structure database: Protein Data Bank

Bibliographic databases (Finding Scientific Articles): PubMed

Miscellaneous: Gene expression Omnibus, OMIM, KEGG, SCOP, CATH. REBASE

Module 3 – Alignment (15 hours)

Sequence comparison, Pair wise sequence alignment, Global alignment: Use of ALIGN, Local alignment: Use of BLAST, FASTA .Amino acid substitution matrices PAM and BLOSUM, Multiple sequence alignment: Use of ClustalW, Phylogenetic analysis: Use of PHYLIP, MEGA

Module 4 - Molecular Visualization Tools (14 hours)

Molecular structure viewers: RasMol, SWISS-PDB Viewer. Predicting protein structure and function from sequence. Protein modeling, Docking and drug discovery

Reference

1. Baldi P and Brunak S, (2001) Bioinformatics: A Machine Learning Approach. MIT Press
2. David W Mount,(2001) Bioinformatics: sequence and genome analysis, CBS Publishers
3. Cynthia Gibas and Per Jambeck. O'Reilly, (2001) Developing Bioinformatics Computer Skills. Wiley-Liss.
4. Cantor CR and SmithCL, (1971) Genomics: The Science and Technology Behind the Human Genome Project. John Wiley and Sons.
5. Orpita Bosu, Simminder Kaurthukral, (2007) Bioinformatics, databases, tools and algorithms, .Oxford university press.

BBBT609: INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGY

Total Hours: 54

Credit: 3

Objective: To motivate students to develop innovative bioremedial measures to reduce pollution and to exploit the industrial applications of various microbes to produce commercially important novel products.

Outcome: Students gains knowledge about the industrial production of microbes and commercially important products and innovative ideas to eradicate environmental pollution

Industrial Biotechnology

Module 1 – Introduction (4 hours)

Introduction, scope and historical developments, importance of microbes in industry; microbial biomass, microbial enzymes, microbial metabolites and microbial recombinant products. Isolation, screening and genetic improvement of industrially important organisms.

Module 2 – Fermentation (15 hours)

Fermentation, Definition, Submerged fermentation and solid state fermentation. Media for industrial fermentation, major components, water, carbon sources, nitrogen sources, minerals, chelators, oxygen requirement, rheology, foaming and antifoaming agents. Medium optimization: Plackett-Burman design. Fermenter, functions of a fermenter, Design of a fermenter, body construction, types of fermenters: Waldhof type, tower type, airlift type, packed tower type, sterilization of the fermenter, aeration, porous sparger, orifice spurger, nozzle sparger, probes.

Recovery of fermentation products, foam separation, precipitation, filtration, centrifugation

Module 3 (5 hours)

Primary metabolism products, production of amino acids as case study. Secondary metabolites, bacterial antibiotics production. Metabolic pathway engineering of microbes for production of novel product for industry.

Module 4 (2 hours)

Microbial enzymes, amylase, proteases, cellulases, role of enzymes in various industrial processes, Bioaugmentation with production of vitamin C as a case study.

Environmental Biotechnology

Module 1 – Introduction (6 hours)

Introduction to Environmental pollution.Air pollution and control.Water pollution and sewage.Bacteriological analysis of drinking water, Presumptive, completed, and confirmed test.

Module 2 – Microbiology and Biochemistry of Waste Water Treatment (10 hours)

Treatment strategies primary, Secondary and tertiary treatment. Wastewater treatment. Sludge and solid wastes treatment and disposal. Bioreactors for wastewater treatment**.**

Module 3 – Bioremediation and Biodegradation (12 hours)

Biological monitoring of environmental pollution. Biodegradation of Hydrocarbons, cellulose, lignin, pesticides .Role of immobilized cells/enzymes in treatment of toxic compounds. Bioremediation. Production of eco-friendly agricultural chemicals, biopesticides, bio-fertilizers, biodegradable plastics, bio-fuels, compost and composting methods, biogas production

Reference

1. Stanbury, P.F.A. Whitaker and S.J. Hall (1995). Principles of fermentation technology. Pergamon Press.
2. Cruger and Annilesse cruger (1990). A textbook of industrial microbiology, sinaser associates. Inc.
3. Chatterjee AK (2011). Environmental Biotechnology Asoke K. Ghosh, PHI Learning Private Limited, M-97, Connaught Circus, New Delhi-110001
4. Jogdand SN (2015). Environmental Biotechnology , Himalayan publication
5. Nuzhat Ahmed, Fouad M. Qureshi and Obaid Y. Khan, (2006) Industrial and Environmental Biotechnology -. Horizon Press.

PRACTICAL

BBBT6P07: METHODS IN MOLECULAR BIOLOGY AND GENETIC ENGINEERING

Total Hours: 54

Credit: 1

1. Isolation of chromosomal and plasmid DNA from bacterium
2. Restriction digestion of DNA and assigning restriction sites
3. Isolation of plant genomic DNA
4. Designing a primer for a well characterized *E.coli* gene
5. PCR amplification of the gene from *E.coli* DNA using the designed primer
6. RAPD analysis of three closely related bacterial strains

BBBT6P08: GENOMICS AND BIOINFORMATICS

Total Hours: 54

Credit: 1

1. Analysis of Nucleotide sequence using GENBANK
2. Analysis of Protein sequence using PIR database, SWISSPROT
3. Analysis of structural features of proteins using protein data bank and RASMOL
4. BLAST,FASTA – Similar DNA sequences search
5. Multiple sequence alignment and phylogenetic trees

BBBT6P09: INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGY

Total Hours: 36

Credit: 1

1. Isolation of bacteria through serial dilution and plating technique
2. Isolation of Nitrogen Fixing Bacteria from root nodule of Leguminous plants.
3. Standard plate count of Sewage water sample.
4. MPN analysis of water samples
5. Estimation of dissolved oxygen
6. IMViC test
7. Production of wine and recovery of alcohol
8. Production of one enzyme through solid state fermentation
9. Production of an enzyme through submerged fermentation
10. Immobilization of enzymes using sodium alginate
11. Immobilization of yeast cells using sodium alginate

Model Question Paper

ST BERCHMANS COLLEGE CHANGANASSERRY (Autonomous)

B.Sc. Botany & Biotechnology Examination (Model question paper)

Sixth Semester

Methods in Molecular Biology and Genetic Engineering

Time : 3 Hrs **Max Marks: 60**

PART A

(Answer any ten. Each question carries 2 marks)

1. _____ enzyme is used in making cDNA from transcripts
2. What is the role of absolute alcohol in DNA Isolation?
3. Nitrocellulose membrane
4. Recognition site of EcoR1.
5. What is the role of IPTG?
6. Significance of YAC.
7. Structure of pUC.
8. What is Klenow fragment?
9. What are Probes?
10. Western Blotting
11. Explain pBR322
12. What are Phagemids? **(10×2=20)**

Part B

(Answer any six. Each question carries 4 marks)

13. Explain the principle of Blue-white screening.
14. Compare AFLP and RAPD techniques.
15. What is the different phage derived vectors?
16. Explain the principle and procedure of Real time PCR.
17. Write briefly on *Agrobacterium* mediated gene transfer? Discuss the two different system of Ti derived plasmids?
18. Write notes on pyrosequencing.
19. Explain DNA foot printing.
20. Write notes on M13 phage based vectors
21. Explain in detail about the probe preparation via nick translation **(6×4=24)**

Part C

(Answer any 2. Each question carries 8 marks)

22. Explain in detail about the restriction enzyme nomenclature and classification with suitable examples.
23. Discuss any five Types of PCR and its applications.
24. Write in detail about genomic and cDNA libraries.
25. Give an account on screening of recombinants. **(8×2=16)**

ST BERCHMANS COLLEGE CHANGANASSERRY (Autonomous)

B.Sc. Botany & Biotechnology Examination (Model question paper)

Sixth Semester

GENOMICS AND BIOINFORMATICS

Time : 3 Hrs **Max Marks: 60**

PART A

(Answer any ten. Each question carries 2 marks)

1. Dotplot.
2. Global and Local alignment.
3. NCBI.
4. Fasta format.
5. http.
6. Datamining.
7. SWISSPROT.
8. Composite database.
9. OMIM.
10. BioEdit.
11. CLUSTAL W.
12. E value. **(10×2=20)**

Part B

(Answer any six. Each question carries 4 marks)

13. Explain types of BLAST and its use.
14. Give an account on application of Bioinformatics.
15. Explain amino acid substitution matrices.
16. Describe the major findings of Arabidopsis thaliana genome project.
17. Write a note on protein sequence and structure databases.
18. Give an account of homology modelling.
19. Describe Chou-Fasman method of secondary structure prediction.
20. Describe the significance of PubMed in research.
21. Explain phylogenetic analysis. Explain any two software used in tree construction.

(6×4=24)

Part C

(Answer any 2. Each question carries 8 marks)

22. Give a detailed account on various visualisation tools used in Bioinformatics.

23. Give an account of docking and its role in drug discovery.
24. What is the significance of data organization in bioinformatics? Explain various biological databases with their significance.
25. Explain the major findings Human genome project. **(8×2=16)**

ST.BERCHMANS COLLEGE (AUTONOMOUS), CHANGANASSERRY

BSc. Botany & Biotechnology Examination (Model question paper)

VI SEMESTER

INDUSTRIAL BIOTECHNOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY

Time: 3 Hrs **Total marks: 60**

Part A

(Answerany 10 questions. Each question carries 2 marks)

1. Differentiate between Biopesticides and Biofertilizers.
2. Define secondary metabolites with example.
3. What is metabolic engineering?
4. Define Microbial Biomass
5. What is the significance of an air sparger?
6. Plackett-Burman design.
7. Air lift fermenter.
8. What are Biofuels. Give example?
9. Write note on antifoam agents.
10. Write note on Newtonian fluids.
11. Define solid state fermentation.
12. Mention the importance of Microbes in Industry **(10×1=20)**

Part B

(Answer any 6. Each question carries 4 marks)

13. Give an account on role of immobilized cells/enzymes in treatment of toxic components.
14. Write note on microbial recombinant products.
15. Explain the process of bioaugmentation with the production of Vitamin C.
16. Describe the significance of sparger and impeller in a fermenter.
17. Explain the production and applications of microbial enzymes.
18. Describe the various processes used for recovery of fermentation products.
19. Comment on the basic requirements for a good fermenter and mention the various types of fermenters with their features.
20. Explain the production of amino acids.
21. Describe fermentation media. Mention its various components. **(6×4=24)**

Part C

(Answer any 2. Each question carries 8 marks)

22. Explain the Isolation, Screening and Genetic Improvement of Industrially important organisms.
23. Write an essay on biological monitoring of environmental pollution using Bioremediation.
24. Describe the design of a typical Fermenter.
25. Explain the industrial production of secondary metabolites with examples. **(8×2=16)**

ELECTIVE COURSES

BBBT6E01: ANIMAL BIOTECHNOLOGY AND NANOBIOTECHNOLOGY

Total Hours: 54

Credit: 3

Objective: To educate the basic concepts of Animal cell culture and the uses of nanomaterials in different field of nanotechnology

Outcome: On the completion of this course, students gets knowledge about various techniques, process and its applications in the field of Animal biotechnology and Nanobitechnology.

Animal Biotechnology (36 hours)

Module 1 – Animal Cell Culture Basics (8 hours)

Structure of animal cell, Infrastructure requirements for animal cell culture laboratory, Cell culture media and reagents, Behaviour of cells in culture conditions, division, their growth pattern, estimation of cell number.

Culture of mammalian cells, tissues and organs, primary culture, Passage number, secondary culture, suspension cultures , Development of cell lines, characterization and maintenance of cell lines, stem cells, cryopreservation, common cell culture contaminants.

Module 2 – In vitro Fertilization and Animal Cloning (7 hours)

Structure of sperms and ovum, cryopreservation of sperms and ova of livestock, artificial insemination, super ovulation, *in vitro* fertilization, culture of embryos, cryopreservation of embryos, embryo transfer, embryo-splitting

Animal cloning basic concept, cloning from embryonic cells and adult cells, cloning of different animals, cloning for conservation of endangered species, Ethical, social and moral issues related to cloning

Module 3 – Transgenic Animals (14 hours)

Transgenic manipulation of animal embryos, animal viral vectors, different applications of transgenic animal technology, Transgenic animal production, biopharming, Gene knock out technology, Ethical, social and moral issues related to the production of transgenic animals, Gene therapy, somatic cell therapy, germline therapy, gene augmentation therapy, gene replacement therapy, Candidate diseases for gene therapy, Current status of gene therapy

Module 4 – Applications of animal cell culture (7 hours)

Application of animal cell culture for in vitro testing of drugs, testing of toxicity of environmental pollutants in cell culture, application of cell culture technology in production of human and animal viral vaccines and pharmaceutical proteins.

Nanobiotechnology (18 hours)

Module 1 - Basic concepts and Fundamentals of Nanotechnology (6 hours)

Historical Aspects of Nanotechnology, Modern Aspects of Nanotechnology, Biomimetics Nanomaterials, Types of various Nanostructures materials, Properties of Nanostructures materials, Quantum wire –Quantum well –Quantum dot –Dendrimers, Nano-robots, Carbon Nanotubes and applications –Graphene and applications, Properties and technological advantages of Nanomaterials.

Module 2 – Biomaterials (6 hours)

Chemical, Physical and biological properties of biomaterials and bio response, Biosynthesis and properties of natural materials (Proteins, DNA and polysaccharides), Polymeric materials- synthetic polymers and structural proteins, Statistical mechanics in biological systems

Module 3 – Synthesis of Nanoparticles (6 hours)

Top-down and Bottom-Up approaches, Physical, Chemical and Biological fabrication of nanoparticles - Characterization of nanomaterials. *Applications* –Nano particular carrier system, Nano fluidics, Nanofabrication, Biosensors, Nano-imaging, Gene therapy, Nano manipulation and Nanolithography, Nano-computation, Nanotechnology in Agriculture/Food, Nanotechnology in Electronics, Nanotechnology in Textile, Nanotechnology in Energy, Nanotechnology in Medicine and Pharmaceuticals, Nanotechnology in Environment, and Nano toxicology

References

1. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse (2005) “Nano Technology – Basic Science and Emerging Technologies”, 1st edition, Overseas Press, New Delhi,.
2. Nalwa H.S. (2005). Handbook of Nanostructured biomaterials and their applications in Nanobiotechnology. American Scientific publications
3. Niemeyer CM and Mirkin CA. (2005). Nanobiotechnology. Wiley

BBBT6E02: IPR AND PATENTS

Total hours: 54

Credit: 3

Objective: The course ensure students to introduce students to Intellectual Property Rights and Patenting in biology and re-emphasize the concepts of Biosafety.

Outcome: By the end of the course, the student will be able to gain an understanding of the basic concepts of IPR and importance of Biosafety levels in various scenario.

Module 1 (6 hours)

Biosafety levels of Specific Microorganisms, Recommended Biosafety Levels for Infectious Agents and Infected Animals.

Module 2 (12 hours)

General guidelines for DNA research containment facilities and biosafety practices, special guidelines in India.

Module 3 (12 hours)

Forms of IPR - patent, design and copyright: Patents: different types of intellectual property, Introduction to patent law and conditions for patentability; Procedure for obtaining patents; Rights of a patentee; Patent infringements; Biotechnology patents and patents on computer programs; Patents from an international perspective.

Module 4 (12 hours)

Copyright: Registration procedure and copyright authorities; Assignment and transfer of copyright, Copyright infringement and exceptions to infringement; Software copyright

Module 5 (12 hours)

IPR laws: Rights/protection, infringement or violation, remedies against infringement: civil and criminal; Indian Patent Act 1970 and TRIPS; IPR forms, IPR in India, patents, process of patenting, Indian and International agencies involved in patenting, GATT

References

1. P. Narayanan (2001), Intellectual Property Laws, Eastern Law House.
2. Meenu Paul (2009), Intellectual Property Laws, Allahabad Law Agency.
3. John E. Smith (2007) Biotechnology, 3rdEd. Cambridge University Press.
5. Prithipal Singh (2007), An Introduction to Biodiversity, Ane Books India.
6. B R Goel (2006) An Introduction to Biodiversity, Arise Pub,
7. Nirmal Chandra Pradhan, (2008) Basics of Biodiversity, Anmol.
8. Scientific, Chapman and Reiss (2007) Ecology principles and applications. Cambridge University.

BBBT6E03: PHYTOCHEMISTRY AND PHARMACOGNOSY

Theory: 54 hours

Credit: 3

Objectives:

- Understand the structure and function of basic secondary metabolites in medicinal and aromatic plants.
- Familiarize with the common separation and characterization techniques used in phytochemistry
- Understand the basic officinal part present in the common medical plants and their use in ayurvedic formulations

Phytochemistry

Module 1: Introduction (2 hours)

Introduction to phytochemical approaches: morphological, organoleptic, microscopic - to study drug and aromatic plants.

Module 2: Extraction of phytochemicals (4 hours)

Extraction and characterisation techniques: cold extraction, hot extraction - soxhlet-clevenger apparatus; Solvents - petroleum ether, chloroform, ethanol, water. Separation techniques - TLC, Column, HPLC. Characterization techniques - GC/MS, HPTLC, UV Spectra, IR Spectra.

Module 3: Effect of phytochemicals **(**10 hours)

Study of the drug plants and their active principles. Alkaloids - introduction, properties, occurrence, structure, classification, functions, and pharmacological uses. Triterpenoids. Introduction, properties, occurrence, classification, functions and pharmacological uses. Phenolics. Quinines - benzoquinones, napthoquinones, anthraquinone, and coumarins.

Module 4: Plants of importance (20 hours)

Study of the following plants with special reference to habit, habitat and systematic position and morphology of the useful part; organoleptic, anatomical and chemical evaluation of the officinal part; phytochemistry and major pharmacological action of plant drugs and ayurvedic formulations made using the plant: *Tinospora cordifolia, Papaver somniferum, Aegle marmelos, Punica granatum, Adhatoda vasica, Withania somnifera, Achyranthes aspera, Asparagus racemosus, Sida acuta, Carica papaya, Azadirachta indica, Phyllanthus neruri, Datura stramonium, Aloe veera, Tylophora indica,, Acorus calamus.*

Module 5: Aromatic plants and their uses (10 hours)

Study of the following aromatic plants - volatile oils and methods of extraction *Vetiveria zizanoides, Cinnamomum zeylanica, Sysygium aromaticum, Santalum album, Eucalyptus, Ocimum bacilicum, Rosa, Mentha piperita, Cympopogon, Cananga, Pelargonium.*

Pharmacognosy

Module 1: Pharmocognosy (4 hours)

Introduction, tools for identifying adulteration; methods in pharmocognosy - microscopy, phytochemical methods - study of starch grains of maize, wheat, rice, potato, curcuma.

Module 2: Ethnomedicine (4 hours)

Traditonal plant medicines as a source of new drugs – The process of modern drug discovery using ethnopharmacology – Taxol, Artemisinin, Galathamine and Flavopyridole as examples of drug discovery based on ethanopharmacological approach. Jeevani-Pushpangadan model of benefit sharing.

Suggested additional topics:

1. Basic principles in spectroscopy - UV, NMR, IR etc.
2. Use of secondary metabolites for protection against pathogens, herbivores.

References

1. Ashutosh Kar, 2006, *Pharmacognosy and Pharmacobiotechnology*, New Age International, New Delhi
2. Atal. C K, Kapur B M, 1982. *Cultivation and Utilization of Medicinal Plants*.
3. Bhattacharjee S K, 2003, *Hand Book of Medicinal Plants*, Pointer Publishers, Jaipur
4. Daniel M, 1991. *Methods in plant chemistry and Economic Botany.* Kalyani publishers, New Delhi.
5. Glossary *of Indian Medicinal Plants with Active Principles* Part I & II, 1980. CSIR, New Delhi.
6. *Indian Medicinal Plants* (5Vols) 1994. Arya Vaidya Sala Kottackal, Orient Longman New Delhi.
7. Irfan Ali Khan, 2008. *Medicinal and Aromatic plants of India*, Ukaaz Publishers, Hyderabad
8. Jain S K 2004. *A Manual of Ethnobotany*, Scientific Publishers, India
9. Khory R N 1999. *Materia Medica of India and their Therapeutics*, Komal Prakashan, Delhi

10. Krishnaswamy N R 2003. *Chemistry of Natural Products*, Universities press, Hyderabad
11. Pushpangaden P Nyman ULF George V. *Glimpses of of Indian Ethno Pharmacology*. The Royal Danish School of Pharmacy Copenhagen, Denmark.
12. Trease, Evans, 2002. *Pharmacognosy*, W.B. Saunders Co., Ltd.
13. Trivedi P C, 2007. *Medicinal Plants Utilisation and Conservation*, Avishkar Publishers, Jaipur 14. Upadhyaya R C, 2008. *The treatise on Aromatic plants*, Anmol Publications, New Delhi
14. Wallis T E, 1997. *Text Book of Pharmacognosy*. CBS Publication & Distribution.
15. Wealth of India, (XI Vols) 1985. CSIR.

BBBT6E04: DEVELOPMENTAL BIOLOGY

Total Hours: 54

Credit: 3

Objective: Enable students to have a clear understanding of basic concepts of development and also embryonic and postembryonic development in plants and animals

Outcome: Students will gain knowledge on essential aspects of plant and animal development and will be able to use it for further research in the field of life sciences

Module 1 - Basic Concepts of Development (6 hours)

Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development

Module 2 - Gametogenesis, Fertilization and Early Development (12 hours)

Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

Module 3 - Morphogenesis and Organogenesis in Animals (12 hours)

Cell aggregation and differentiation in *Dictyostelium*; axes and pattern formation in *Drosophila* and amphibia; organogenesis– vulva formation in *Caenorhabditis elegans*, limb development and regeneration in vertebrates, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination.

Module 4 - Morphogenesis and Organogenesis in Plants (12 hours)

Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in *Arabidopsis* and *Antirrhinum*

Module 5 - Programmed Cell Death, Aging and Senescence (12 hours)

Necrosis, Apoptosis, caspases, Extrinsic and intrinsic pathway, aging, mitochondrial stress, senescence

References

1. Scott F. Gilbert, Developmental Biology, Seventh Edition (2003), Sinauer Associates, Inc., Sunderland, MA,ISBN 0-87893-258-5

2. John Gerhart and Marc Kirschner, Cells, Embryos, and Evolution, (1997), Blackwell Science, ISBN 0-86542-574-4,
3. Fred H. Wilt & Sarah C. Hake (2004), Principles of Developmental Biology, , W.W. Norton& Company, Inc., New York, NY,ISBN 0-393-97430-8
4. Sally A. Moody,(1998) Cell Lineage and Fate Determination**,** Academic Press, Inc., ISBN 0-12-505255-3
5. Lewis Wolpert, Rosa Beddington, Thomas Jessell, Peter Lawrence, Elliot Meyerowitz, Jim Smith (2002) Principles of Development, Second Edition, Oxford University Press, ISBN 0-19-924939-3

Model Question Paper

ST.BERCHMANS COLLEGE (AUTONOMOUS), CHANGANASSERRY

BSc Botany & Biotechnology (Model Question Paper)

VI SEMESTER

ANIMAL BIOTECHNOLOGY AND NANOBIOTECHNOLOGY

Time: 3 Hrs **Total marks: 80**

Part A

(Answer any 10 questions. Each question carries 2 marks)

1. What is Carbon Nanotubes?
2. Define Quantum Dots
3. What is Biosensors?
4. Mention the properties of Nanoparticles.
5. What is Gene Replacement Therapy
6. What is Super Ovulation?
7. Give two examples of Cloned animals
8. What is Suspension Culture?
9. What is the use of CO2 Incubator?
10. Mention the different Phases of Bacterial growth curve?
11. What is Cryopreservation, Give example for Cryoprotectant?
12. What is Hayflick's Limit? **(10×=20)**

Part B

(Answer any 6. Each question carries 5 marks)

13. Explain the methods used for estimation of animal cell number
14. Write note on different approaches of Gene therapy
15. Explain the Procedure on In-Vitro Fertilization
16. What is Embryo transfer, Explain the Procedure?
17. Explain the Procedure of Cloning and its use in the conservation of endangered species
18. What are the different types of Vectors used in Gene therapy
19. Explain the features and application of Dendrimers
20. What are the properties of Biomaterials
21. What is Biopharming? **(6×5=30)**

Part C

(Answer any 2. Each question carries 15 marks)

22. Explain the Composition and different types of media used in Animal Cell Culture.

23. Explain the Characterization and Maintenance of Cell Lines
24. Write note on Transgenic animals and its applications
25. Write a note on synthesis of Nanoparticles. **(15×2=30)**

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