DEPARTMENT OF MICROBIOLOGY

Curriculum and Syllabus for Postgraduate Programme in Microbiology
Under Credit Semester System
(with effect from 2015 admissions)

St Berchmans College
Affiliated to Mahatma Gandhi University, Kottayam, Kerala
Changanassery, Kottayam, Kerala, India-686101
DEPARTMENT OF MICROBIOLOGY

Curriculum and Syllabus for Postgraduate Programme in Microbiology
Under Credit Semester System
(with effect from 2015 admissions)
OBJECTIVES OF THE PROGRAMME:

On completion of the course candidates shall have achieved the following objectives:

- A detailed knowledge of structure, function and application of microorganisms.
- Skills in handling microorganisms in the laboratory.
- An understanding of applications of microorganisms in the industry, health-care, environmental protection, food, agriculture and research.
- Understanding current trends in microbiology and critically appraising published work.
- Demonstrating an ability to design, undertake and interpret a research project presented in the form of a dissertation.
MISSION
Provide quality education and impart futuristic scientific skills

VISION
• Our vision is to produce highly qualified and competent students in all the
  selected area of Microbiology
• Cooperation with other scientific departments and faculties for establishing
  interdisciplinary specialization such as biophysics, bioinformatics, medical
  microbiology, etc.
• Continuous strengthening of the scientific and cultural relationships with the
  scientific organizations
• Preparation of graduates who can fulfill the needs of the scientific research
  laboratories, and the national projects
• Provision of an educational system that faculties preparation for young and
  brilliant scientists who contribute in the development of the society.
• Focusing on the studies and researches in both academic and applied fields that
  aim at development and community services.
MEMBERS OF BOARD OF STUDIES

1. **Chairman**
   **Dr. Jose D. Kaipallil**
   Associate Professor
   Department of Zoology
   S. B College
   Changanassery

2. **Dr. Jisha M. S.**
   Associate Professor
   School of Biosciences
   M.G University
   Kottayam

3. **Dr. Radhakrishnan E. K.**
   Assistant Professor
   School of Biosciences
   M.G University
   Kottayam

4. **Dr. Lincy Sara Varghese**
   Assistant Professor
   Department of Microbiology
   Bishop Kurialacherry College for Women,
   Amalagiri, Kottayam

5. **Dr. Girilal M.**
   Adjunct Faculty
   School of Biosciences
   M.G University
   Kottayam

6. **Dr. Saji Varghese**
   Managing Director
   Mangalam Diagnostic Centre
   Kottayam

7. **K. J. Jacob**
   Director
   Agro Bio-Tech Research Centre Ltd,
   Industrial area, Poovanthuruthu P.O.
   Kottayam
8. Dr. Jomon K. V.
   Assistant Professor
   Department of Zoology
   S.B College
   Changanassery

9. Jeena M John
   Assistant Professor on contract
   Department of Microbiology & Biochemistry
   S.B College
   Changanassery

10. Sweety K Ennacheril
    Assistant Professor on contract
    Department of Microbiology & Biochemistry
    S.B College
    Changanassery

11. Jiji Jacob
    Assistant Professor on contract
    Department of Microbiology & Biochemistry
    S.B College
    Changanassery

12. Dr. Vincy Mary Varghese
    Assistant Professor on contract
    Department of Zoology
    S.B College
    Changanassery

13. Anju Susan Joy
    Assistant Professor on contract
    Department of Zoology
    S.B College
    Changanassery
REGULATIONS FOR POSTGRADUATE PROGRAMMES IN MICROBIOLOGY UNDER CREDIT SEMESTER SYSTEM 2015

1. SHORT TITLE
1.1 These Regulations shall be called St. Berchmans College (Autonomous) Regulations (2015) governing postgraduate programme in Microbiology under the Credit Semester System (SB-CSS-PG).
1.2 These Regulations shall come into force with effect from the academic year 2015-2016 onwards.

2. SCOPE
2.1 The regulation provided herein shall apply to postgraduate programme in Microbiology, conducted by St. Berchmans College (Autonomous) with effect from the academic year 2015-2016.

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-PG system.
3.4 ‘Academic Council’ means the Committee consisting of members as provided under section 107 of the Autonomy Ordinance, Government of Kerala.
3.5 ‘Parent Department’ means the Department of Microbiology.
3.6 ‘Department Council’ means the body of all teachers of the department of Microbiology.
3.7 ‘Faculty Mentor’ is a teacher nominated by a Department Council to coordinate the continuous evaluation and other academic activities of the postgraduate programme in Microbiology, undertaken in the Department.
3.8 ‘Programme’ means the entire course of study and examinations.
3.9 ‘Duration of Programme’ means the period of time required for the conduct of the programme. The duration of the postgraduate programme in Microbiology, shall be four (4) semesters.
3.10 ‘Semester’ means a term consisting of a minimum of ninety (90) working days, inclusive of examination, distributed over a minimum of eighteen (18) weeks of five (5) working days each.
3.11 ‘Course’ means a segment of subject matter to be covered in a semester. Each Course is
to be designed under lectures / tutorials / laboratory / seminar/ project/ practical/
assignments/ evaluation etc., to meet effective teaching and learning needs.
3.12 ‘Course Teacher’ means the teacher who is taking classes on the course.
3.13 ‘Core Course’ means a course that the student admitted to the postgraduate programme
in Microbiology must successfully complete to receive the Degree and which cannot be
substituted by any other course.
3.14 ‘Elective Course’ means a course, which can be substituted, by equivalent course from
the same subject and the number of courses required to complete the programme shall
be decided by the Board of Studies.
3.15 ‘Project’ means a regular project work with stated credits on which the student conducts
a project under the supervision of a teacher in the department/any appropriate research
centre in order to submit a dissertation on the project work as specified.
3.16 ‘Dissertation’ means a minor thesis to be submitted at the end of a research work
carried out by each student under the supervision of a teacher in the parent department
on a specific area.
3.17 ‘Plagiarism’ is the unreferenced use of other authors’ material in dissertations and is a
serious academic offence.
3.18 ‘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.
3.19 ‘Tutorial’ means a class to provide an opportunity to interact with students at their
individual level to identify the strength and weakness of individual students.
3.20 ‘Evaluation’ means every student shall be evaluated by in-semester assessment (25%)
and end-semester assessment (75%).
3.21 ‘Improvement Examination’ is an examination conducted to improve the performance
of students in the courses of a particular semester.
3.22 ‘Supplementary Examination’ is an examination conducted for students who fail in the
courses of a particular semester.
3.23 ‘Improvement Course’ is a course registered by a student for improving the
performance in that particular course.
3.24 ‘Supplementary Course’ is a course that is repeated by a student for having failed in that
course in an earlier registration.
3.25 The minimum credits required for completing postgraduate programme in Microbiology, is eighty (80).

3.26 ‘Credit’ (C) of a course is a measure of the weekly unit of work assigned for that course in a semester.

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

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

3.29 ‘Grade Point’ (GP) is the numerical indicator of the percentage of marks awarded to a student in a course.

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

3.31 ‘Semester Credit Point Average’ (SCPA) 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.

3.32 ‘Cumulative Credit Point Average’ (CCPA) 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.

3.33 ‘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 respective course.

3.34 ‘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.

3.35 ‘Grace Marks’ means marks awarded to course/courses, in recognition of meritorious achievements of a student in NCC/NSS/Sports/Arts and cultural activities.

3.36 First, Second and Third position shall be awarded to students who come in the first three places on the basis of overall marks in the programme in the first chance itself.

4. PROGRAMME STRUCTURE

4.1 Students shall be admitted into the four semester postgraduate programme in Microbiology.
4.2 The programme shall include two types of courses; Core Courses and Elective Courses. There shall be a Project with dissertation to be undertaken by all students. The programme will also include assignments, seminars, practical, viva-voce etc.

4.3 Total credits for the programme is eighty (80). No course shall have more than four (4) credits.

4.4 Project/Dissertation

Project shall be completed by working outside the regular teaching hours. Project shall be carried out under the supervision of a teacher in the department of Microbiology and Biochemistry. A student may, however, in certain cases be permitted to work on the project in an industrial/research organization on the recommendation of the Supervisor. There shall be an internal assessment and external assessment for the project. The external evaluation of the project work is followed by presentation of work including dissertation and viva-voce. The following guideline shall be followed while preparing the project report.

**Title** - should include be concise and informative

**Abstract** - 150 to 250 words. The abstract should not contain any undefined abbreviations or unspecified references.

**Text Formatting**

Manuscripts should be submitted in Word.

- Use a normal, plain font (e.g., 12-point Times Roman) for text.
- Use italics for emphasis.
- Use the automatic page numbering function to number the pages.
- Use the table function, not spreadsheets, to make tables.
- Save your file in docx format (Word 2007 or higher) or doc format (older Word versions).

**Headings**

Please use no more than three levels of displayed headings. (Eg: 1.1; 1.1.1; 1.1.1)

**Abbreviations**

Abbreviations should be defined at first mention and used consistently thereafter.

**Footnotes**

- Footnotes can be used to give additional information, which may include the citation of a reference included in the reference list. They should not consist solely
of a reference citation, and they should never include the bibliographic details of a reference. They should also not contain any figures or tables.

- Footnotes to the text are numbered consecutively; those to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data).

**Reference list**
The list of references should only include works that are cited in the text and that have been published or accepted for publication. Personal communications and unpublished works should only be mentioned in the text. Do not use footnotes or endnotes as a substitute for a reference list.

Reference list entries should be alphabetized by the last names of the first author of each work.

- **Journal article**

- **Article by DOI**

- **Book**

- **Book chapter**

- **Online document**

Journal names and book titles should be italicized.
All tables are to be numbered using Arabic numerals.

Tables should always be cited in text in consecutive numerical order.

For each table, please supply a table caption (title) explaining the components of the table.

Footnotes to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data) and included beneath the table body.

**Figures**

- Figures should be in JPEG or TIFF format.

**Figure Numbering**

- All figures are to be numbered using Arabic numerals.
- Figures should always be cited in text in consecutive numerical order.
- Figure parts should be denoted by lowercase letters (a, b, c, etc.).
- If an appendix appears in your article and it contains one or more figures, continue the consecutive numbering of the main text. Do not number the appendix figures.

**Figure Captions**

- Each figure should have a concise caption describing accurately what the figure depicts.
- Figure captions should be provided below the figure.
- Figure captions begin with the term Fig. in bold type, followed by the figure number, also in bold type.
- Figures and figure captions are to be centralized.
- No punctuation is to be included after the number, nor is any punctuation to be placed at the end of the caption.
- Identify all elements found in the figure in the figure caption; and use boxes, circles, etc., as coordinate points in graphs.

**4.5 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 is 1:3. Marks for ISA is 25 and ESA is 75 for all courses.
4.6 **In-semester assessment of theory courses**

There are four components for ISA, which include attendance, assignment, seminar and in-semester examination.

<table>
<thead>
<tr>
<th>Components of ISA</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance</td>
<td>5</td>
</tr>
<tr>
<td>Assignment</td>
<td>5</td>
</tr>
<tr>
<td>Seminar</td>
<td>5</td>
</tr>
<tr>
<td>In-semester examination (2×5 = 10)</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
</tr>
</tbody>
</table>

4.7 **Attendance evaluation of students for each course shall be as follows:**

<table>
<thead>
<tr>
<th>% of Attendance</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>95 and above</td>
<td>5</td>
</tr>
<tr>
<td>90-94</td>
<td>4</td>
</tr>
<tr>
<td>85-89</td>
<td>3</td>
</tr>
<tr>
<td>80-84</td>
<td>2</td>
</tr>
<tr>
<td>75-79</td>
<td>1</td>
</tr>
</tbody>
</table>

4.8 **Assignments**

Every student shall submit one assignment as an internal component for every course.

4.9 **Seminar**

Every student shall deliver one seminar as an internal component for every course. The seminar is expected to train the student in self-study, collection of relevant matter from the books and internet resources, editing, document writing, typing and presentation.

4.10 **In-semester examination**

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

4.11 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 for 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 should be kept in the office of the Head of the Department for at least two years for verification.
4.12 **In-semester assessment of practical courses**

The internal assessment of practical courses shall be conducted in each semester. There shall be one in-semester examination for practical courses. The examination shall be conducted in each semester.

4.13 **End-semester assessment**

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

4.14 The end-semester examinations for theory courses 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.

4.15 The question paper should be strictly on the basis of model question paper set by Board of Studies.

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

<table>
<thead>
<tr>
<th>Division</th>
<th>Type</th>
<th>No. of Questions to be Answered</th>
<th>Mark for Each Question</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part A</td>
<td>Short answer</td>
<td>10 out of 13</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Part B</td>
<td>Short essay</td>
<td>5 out of 8</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Part C</td>
<td>Essay</td>
<td>2 out of 4</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td><strong>Grand Total</strong></td>
<td><strong>17 out of 25</strong></td>
<td></td>
<td><strong>75</strong></td>
</tr>
</tbody>
</table>

4.17 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.

4.18 Practical examination shall be conducted in each semester. Practical examination shall be conducted by one external examiner and one internal examiner. The question paper setting and evaluation of answer scripts shall be done as per the directions in the examination manual of the College.

4.19 Project/Dissertation evaluation shall be conducted at the end of the programme. Project evaluation shall be conducted by one external examiner and one internal examiner. The components and mark division for internal and external assessment shall be decided by the respective Board of Studies.
The components and mark division for internal and external assessment are given below.

**Internal assessment**

<table>
<thead>
<tr>
<th>Components</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thesis preparation</td>
<td>10</td>
</tr>
<tr>
<td>Presentation</td>
<td>10</td>
</tr>
<tr>
<td>Viva</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
</tr>
</tbody>
</table>

4.20 Comprehensive viva-voce shall be conducted at the end of the programme. Viva-voce shall be conducted by one external examiner and one internal examiner. The viva-voce shall cover questions from all courses in the programme. There shall be no internal assessment for comprehensive viva-voce. The maximum marks for viva-voce is one hundred (100).

4.21 For all courses (theory and practical) an indirect grading system based on a ten (10) 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.

<table>
<thead>
<tr>
<th>Percentage of Marks</th>
<th>Grade</th>
<th>Performance</th>
<th>Grade Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 and above</td>
<td>A+</td>
<td>Outstanding</td>
<td>10</td>
</tr>
<tr>
<td>80 - 89</td>
<td>A</td>
<td>Excellent</td>
<td>9</td>
</tr>
<tr>
<td>70 - 79</td>
<td>B</td>
<td>Very Good</td>
<td>8</td>
</tr>
<tr>
<td>60 - 69</td>
<td>C</td>
<td>Good</td>
<td>7</td>
</tr>
<tr>
<td>50 - 59</td>
<td>D</td>
<td>Satisfactory</td>
<td>6</td>
</tr>
<tr>
<td>40 - 49</td>
<td>E</td>
<td>Adequate</td>
<td>5</td>
</tr>
<tr>
<td>Below 40</td>
<td>F</td>
<td>Failure</td>
<td>-</td>
</tr>
</tbody>
</table>
4.22 Credit Point
Credit Point (CP) of a course is calculated using the formula

\[ \text{CP} = \text{C} \times \text{GP} \]

where C = Credit; GP = Grade Point

4.23 Semester Credit Point Average
Semester Credit Point Average (SCPA) is calculated using the formula

\[ \text{SCPA} = \frac{\text{TCP}}{\text{TC}} \]

where TCP = Total Credit Point of all the courses in the semester; TC = Total Credits in the semester

SCPA shall be rounded off to two decimal places.

4.24 Cumulative Credit Point Average
Cumulative Credit Point Average (CCPA) is calculated using the formula

\[ \text{CCPA} = \frac{\text{TCP}}{\text{TC}} \]

where TCP = Total Credit Point of all the courses in the whole programme; TC = Total Credit in the whole programme

CCPA shall be rounded off to two decimal places.

Grades for the different semesters, Semester Credit Point Average (SCPA) and grades for overall programme, Cumulative Credit Point Average (CCPA) are given based on the corresponding Credit Point Average (CPA) as shown below:

<table>
<thead>
<tr>
<th>CPA</th>
<th>Grade</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00 and above</td>
<td>A+</td>
<td>Outstanding</td>
</tr>
<tr>
<td>8.00 - 8.99</td>
<td>A</td>
<td>Excellent</td>
</tr>
<tr>
<td>7.00 - 7.99</td>
<td>B</td>
<td>Very Good</td>
</tr>
<tr>
<td>6.00 - 6.99</td>
<td>C</td>
<td>Good</td>
</tr>
<tr>
<td>5.00 - 5.99</td>
<td>D</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>4.00 - 4.99</td>
<td>E</td>
<td>Adequate</td>
</tr>
<tr>
<td>Below 4.00</td>
<td>F</td>
<td>Failure</td>
</tr>
</tbody>
</table>

4.25 A separate minimum of 30% marks each in ISA and ESA (for theory and practical) and aggregate minimum of 40% are required for a pass for a course. For a pass in a programme, a separate minimum of Grade E is required for all the individual courses.

5. SUPPLEMENTARY/IMPROVEMENT EXAMINATION
There will be supplementary examinations and chance for improvement. Only one chance will be given for improving the marks of a course.
6. ATTENDANCE

6.1 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 Postgraduate programme may be granted by the College.

6.2 If a student represents 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., he/she shall be eligible to claim the attendance for the actual number of days participated subject to a maximum of ten (10) days in a semester based on the specific recommendations of the Faculty Mentor and Head of the Department.

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

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

7. BOARD OF STUDIES AND COURSES

7.1 The Board of Studies in Microbiology shall design all the courses offered in the postgraduate programme in Microbiology. 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.

7.2 The syllabus of a course shall include the title of the course, contact hours, the number of credits and reference materials.

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

7.4 Every Programme conducted under Credit Semester System shall be monitored by the Academic Council.

8. REGISTRATION

8.1 A student shall be permitted to register for the programme at the time of admission.

8.2 A student may be permitted to complete the Programme, on valid reasons, within a period of eight (8) continuous semesters from the date of commencement of the first semester of the programme.

8.3 Those students who possess the required minimum attendance and progress during an academic year/semester and could not register for the annual/semester examination in time are permitted to apply for Notional Registration to the examinations concerned enabling them to get promoted to the next semester.
9. ADMISSION
9.1 The admission to postgraduate programme in Microbiology shall be as per the rules and regulations of the College/University.
9.2 The eligibility criteria for admission shall be as announced by the College/University from time to time.
9.3 Separate rank lists shall be drawn up for seats under reservation quota as per the existing rules.
9.4 There shall be an academic and examination calendar prepared by the College for the conduct of the programmes.

10. ADMISSION REQUIREMENTS
10.1 Candidates for admission to the first semester of the postgraduate programme in Microbiology through SB-CSS-PG shall be required to have passed an appropriate degree examination of Mahatma Gandhi University or any University or authority, duly recognized by the Academic council of Mahatma Gandhi University as equivalent thereto.
10.2 Students admitted under this programme are governed by the Regulations in force.

11. PROMOTION
A student who registers for the end semester examination shall be promoted to the next semester.

12. MARK CUM GRADE CARD
12.1 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) Faculty
   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, SCPA and Letter Grade in the semester
   xii) Weighted Average Score
   xiii) Result
12.2 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 CCPA and the overall letter grade of a student for the entire programme.

13. AWARD OF DEGREE

The successful completion of all the courses with ‘E’ grade shall be the minimum requirement for the award of the degree.

14. 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 should keep all the records of the continuous evaluation, for at least a period of two years, for verification.

15. GRIEVANCE REDRESSAL COMMITTEE

15.1 In order to address the grievance of students relating to ISA, a two-level Grievance Redressal mechanism is envisaged.

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

15.3 Department level: The Principal shall form a Grievance Redressal 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.

15.4 College level: There shall be a College level Grievance Redressal 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.

16. 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.
Name of the Candidate : 
Register Number : 
Degree : Master of Science 
Programme : Microbiology 
Name of the Examination : First Semester SB-CSS-PG Examination, Month YYYY 
Faculty : Science 

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits (C)</th>
<th>Marks</th>
<th>Grade Awarded (GP)</th>
<th>Grade Point (CP)</th>
<th>Institution Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>ISA</td>
<td>ESA</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Awarded</td>
<td>Maximum</td>
<td>Awarded</td>
<td>Maximum</td>
</tr>
</tbody>
</table>

Total

Weighted Average Score

Semester Result

SCPA

***End of Statement***

Entered by: 
Verified by: 

Controller of Examinations 
Principal
MARK CUM GRADE CARD

Name of the Candidate: 
Register Number: 
Degree: Master of Science
Programme: Microbiology
Name of the Examination: Fourth Semester SB-CSS-PG Examination, Month YYYYY
Faculty: Science

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits (C)</th>
<th>Marks</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>ISA</td>
<td>ESA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Awarded</td>
<td>Maximum</td>
</tr>
</tbody>
</table>

Core Courses
Elective Courses
Project
Viva-Voce

Total
Weighted Average Score

Semester Result
SCPA

Semester I (Month, Year)
Semester II (Month, Year)
Semester III (Month, Year)
Semester IV (Month, Year)
Grand Total
CCPA

Final Result

***End of Statement***

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 1:3 for all Courses. Grades and Grade Points are given on a ten (10) point scale based on the percentage of Total Marks (ISA + ESA) as given in Table 1. (Decimals are to be rounded mathematically to the nearest whole number)

<table>
<thead>
<tr>
<th>Percentage of Marks</th>
<th>Grade</th>
<th>Performance</th>
<th>Grade Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 and above</td>
<td>A+</td>
<td>Outstanding</td>
<td>10</td>
</tr>
<tr>
<td>80 - 89</td>
<td>A</td>
<td>Excellent</td>
<td>9</td>
</tr>
<tr>
<td>70 - 79</td>
<td>B</td>
<td>Very Good</td>
<td>8</td>
</tr>
<tr>
<td>60 - 69</td>
<td>C</td>
<td>Good</td>
<td>7</td>
</tr>
<tr>
<td>50 - 59</td>
<td>D</td>
<td>Satisfactory</td>
<td>6</td>
</tr>
<tr>
<td>40 - 49</td>
<td>E</td>
<td>Adequate</td>
<td>5</td>
</tr>
<tr>
<td>Below 40</td>
<td>F</td>
<td>Failure</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 1

Semester Credit Point Average (SCPA) and Cumulative Credit Point Average (CCPA)

Grades for the different Semesters and overall Programme are given based on the corresponding Credit Point Average (CPA), as shown in Table 2.

<table>
<thead>
<tr>
<th>CPA</th>
<th>Grade</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00 and above</td>
<td>A+</td>
<td>Outstanding</td>
</tr>
<tr>
<td>8.00 - 8.99</td>
<td>A</td>
<td>Excellent</td>
</tr>
<tr>
<td>7.00 - 7.99</td>
<td>B</td>
<td>Very Good</td>
</tr>
<tr>
<td>6.00 - 6.99</td>
<td>C</td>
<td>Good</td>
</tr>
<tr>
<td>5.00 - 5.99</td>
<td>D</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>4.00 - 4.99</td>
<td>E</td>
<td>Adequate</td>
</tr>
<tr>
<td>Below 4.00</td>
<td>F</td>
<td>Failure</td>
</tr>
</tbody>
</table>

Table 2

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

\[ CP = C \times GP \]

where \( C \) = Credit; \( GP \) = Grade Point

Credit Point Average (CPA) of a Semester/Programme is calculated using the formula

\[ CPA = \frac{TCP}{TC} \]

where \( TCP \) = Total Credit Point; \( TC \) = Total Credit

CPA shall be rounded off to two decimal places.

A separate minimum of 30% marks is required for a pass for both internal assessment and external assessment in each course.

An aggregate minimum of 40% marks is required for a pass in each course.
<table>
<thead>
<tr>
<th>Semester I</th>
<th>Course Code</th>
<th>Name of the Course</th>
<th>Hours/Week</th>
<th>Total Hours</th>
<th>Credits</th>
<th>ISA</th>
<th>ESA</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AMMB101</td>
<td>Biochemistry</td>
<td>4</td>
<td>72</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>AMMB102</td>
<td>General Microbiology</td>
<td>4</td>
<td>72</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>AMMB103</td>
<td>Physiology and Biostatistics</td>
<td>4</td>
<td>72</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>AMMB104</td>
<td>Cell Biology and Genetics</td>
<td>3</td>
<td>54</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>AMMB1P01</td>
<td>Laboratory Course – I (P)</td>
<td>10</td>
<td>180</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>25</strong></td>
<td><strong>450</strong></td>
<td><strong>19</strong></td>
<td><strong>125</strong></td>
<td><strong>375</strong></td>
<td><strong>500</strong></td>
</tr>
<tr>
<td>Semester II</td>
<td>AMMB205</td>
<td>Molecular Biology and Genetic Engineering</td>
<td>4</td>
<td>72</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>AMMB206</td>
<td>Immunology</td>
<td>4</td>
<td>72</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>AMMB207</td>
<td>Biophysics, Bioinstrumentation and Bioinformatics</td>
<td>4</td>
<td>72</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>AMMB208</td>
<td>Metabolism and Enzymology</td>
<td>3</td>
<td>54</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>AMMB2P02</td>
<td>Laboratory Course - II (P)</td>
<td>10</td>
<td>180</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>25</strong></td>
<td><strong>450</strong></td>
<td><strong>19</strong></td>
<td><strong>125</strong></td>
<td><strong>375</strong></td>
<td><strong>500</strong></td>
</tr>
<tr>
<td>Semester III</td>
<td>AMMB309</td>
<td>Food Microbiology and Quality Assurance</td>
<td>4</td>
<td>72</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>AMMB310</td>
<td>Industrial Microbiology</td>
<td>4</td>
<td>72</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>AMMB311</td>
<td>Environmental and Agricultural Microbiology</td>
<td>4</td>
<td>72</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Elective Course</td>
<td>4</td>
<td>72</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AMMB3P03</td>
<td>Laboratory Course - III (P)</td>
<td>9</td>
<td>162</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>25</strong></td>
<td><strong>450</strong></td>
<td><strong>20</strong></td>
<td><strong>125</strong></td>
<td><strong>375</strong></td>
<td><strong>500</strong></td>
</tr>
<tr>
<td>Semester IV</td>
<td>AMMB412</td>
<td>Systematic Bacteriology</td>
<td>5</td>
<td>90</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>AMMB413</td>
<td>Virology, Mycology and Protozoology</td>
<td>5</td>
<td>90</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Elective Course</td>
<td>5</td>
<td>90</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AMMB4P04</td>
<td>Laboratory Course - IV (P)</td>
<td>10</td>
<td>180</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>AMMB4PJ</td>
<td>Project</td>
<td>4</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AMMB4VV</td>
<td>Viva-Voce</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>25</strong></td>
<td><strong>450</strong></td>
<td><strong>22</strong></td>
<td><strong>125</strong></td>
<td><strong>475</strong></td>
<td><strong>600</strong></td>
</tr>
<tr>
<td>Grand Total</td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>80</strong></td>
<td><strong>2100</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## ELECTIVE COURSES

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Name of the Course</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semester III</strong></td>
<td></td>
</tr>
<tr>
<td>AMMB3E01</td>
<td>Nano Biotechnology</td>
</tr>
<tr>
<td>AMMB3E02</td>
<td>Microbial Diversity and Extremophiles</td>
</tr>
<tr>
<td>AMMB3E03</td>
<td>Marine Microbiology</td>
</tr>
<tr>
<td><strong>Semester IV</strong></td>
<td></td>
</tr>
<tr>
<td>AMMB4E04</td>
<td>Clinical Microbiology</td>
</tr>
<tr>
<td>AMMB4E05</td>
<td>Molecular Microbiology</td>
</tr>
<tr>
<td>AMMB4E06</td>
<td>Environmental Science</td>
</tr>
</tbody>
</table>
SEMESTER I

AMMB101: BIOCHEMISTRY

Total Hours: 72

Credits: 4

Unit I
Buffers: physiological buffer. Stabilizing interactions: Covalent bonds; Ionic bonds; Disulfide linkages; Non covalent interactions: Van der Waal’s, electrostatic, hydrogen bonding, hydrophobic interaction etc. Free radicals in biological systems: Pro oxidants and antioxidants in biological systems.

Unit II
Carbohydrates: Classification, basic structure and function. Oligosaccharides: glycosidic bonds; classification: glycoproteins (O-linked and N-linked) glycolipids; nature of carbohydrate moiety attached; functions; as cell recognition factors in intracellular targeting; purification and characterization of oligosaccharides from cell membranes. Polysaccharides: classification– homopolysaccharides (cellulose, starch, chitin, and glycogen), heteropolysaccharides (bacterial peptidoglycans, glycosaminoglycans, hyaluronic acid, and heparin); structural characteristics and functions of above mentioned polyasaccharides; exopolysaccharides from bacterial systems and their uses; purification and characterization of polysaccharides from biological systems.

Unit III

Unit IV
Amino acids: classification, basic structure and reactions; protein-classification and functions. Primary, secondary, tertiary and quaternary structure of proteins w.r.t: globular
protein (e.g., hemoglobin and myoglobin), fibrous protein (collagen), membrane protein (ATP synthetase). Protein structure and molecular approach to medicine: sickle cell anemia. Protein sequencing methods – mass spectrometry and Edman degradation.

Unit V

Nucleic acid structure and function: Types of DNA-A, B and Z. Supercoiling of the DNA molecule-topoisomers and superhelixes. Higher orders of DNA structure: chromatin, histones and nucleosomes, conformation of chromatin fibers. Organization of the DNA sequence-genomes, pseudogenes, extragenic regions (beta globin gene and gene family) duplicated genes. RNA Structure-types of RNA, structure of mRNA, tRNA, rRNA, SiRNA, micro RNA with emphasis on importance of structure to its function.

References

AMMB102: GENERAL MICROBIOLOGY

Total Hours: 72

Credits: 4

Unit I

Unit II

Unit III

Unit IV

Unit V
References


AMMB103: PHYSIOLOGY AND BIOSTATISTICS

Total Hours: 72

Credits: 4

Human Physiology
Introduction to physiology, scope of human physiology, homeostasis, blood buffers, acid-base balance.

Unit I
Digestion, absorption and excretion: digestive secretions - composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids. Vitamins -classification and physiological functions

Unit II

Unit III
Structure of muscle cells and muscle contraction, molecular organization of muscle, proteins of contractile element - their organization and role in contraction, energy for contraction.
Unit IV Plant Physiology
Autotrophy, heterotrophy, photosynthesis, intake of water and nutrients, water balance and transport in plants, xylem transport, phloem transport, transpirations, mineral nutrition, photorespiration. Hormones and growth regulators - auxins, gibberlins, kinins, ethylene and other compounds - physiological function and mechanism of action; seed dormancy and viability, senescence, physiological and biochemical changes during ripening.
Photoreceptors - UVR8, phytochromes, cryptochromes and phototropins. Stress physiology - water stress, physiological effects of biotic and abiotic stress on plants with special reference to temperature, drought, salinity and heavy metals. Totipotency - principles and differentiation; photomorphogenesis; photoperiodism (Long-day plants, Short-day plants and Day-neutral plants).

Unit V Biostatistics
Introduction and scope, collection, classification and tabulation of data, graphical and diagrammatic representations - scatter diagrams, histograms, frequency polygon, frequency curve, logarithmic curves, probability and probability distribution analysis. Measures of central tendency - Arithmetic mean, median, mode, geometric mean, harmonic means. Measures of dispersion, standard deviation, standard error, variance, coefficient of variation, correlation and regression. Principal component analysis, test of significance, hypothesis testing, levels of significance, Chi-square test and goodness of fit, comparison of means of two samples.

References


AMMB104: CELL BIOLOGY AND GENETICS

Total Hours: 54 Credits: 3

Unit I

Unit II
Specialized forms of membranes: brush border; flagella, red cell membranes, microsomal membrane functions. Membrane fluidity, asymmetry, lipid raft, functions of membrane proteins & lipids. Endocytosis and exocytosis; regulation of transport: porins facilitated diffusion, porter molecules; facilitated transport: symport, antiport, uniport, anion porter, glucose porter; active transport: proton pumps; Na\(^+\) K\(^+\) pumps, Ca\(^{2+}\) pumps; ionic channels: general characteristics and types of ionic channels - voltage, gated and ligand gated channels.

Unit III
Cell cycle - different stages, variations, checkpoints, G1/S, G2/M, M, DNA damage check points, regulations of cell cycle, maturation Promoting factor, cell cyclins, ubiquitin, ubiquitination, anaphase promoting complex, inhibitors of CdK, growth factors and D Cyclins, Rb protein, P53 and E2F transcription factors.


Unit IV
Cell Differentiation-Stages of development, regulation of development, cascade control/differentiation in Drosophila, maternal gene interactions—bicoid- nanos system, segmentation genes, pair rule genes, gap genes and homeotic genes, bi thorax mutant,
antennapediac mutant genetic control of embryonic development, homeobox, homeodomain, HOX genes, combinatorial expression, differentiation in plants, floral development-apetalous, pistillate, agamous interactions.


Cell Death: Necrosis and apoptosis, Differences between necrosis and Apoptosis, stages in Apoptosis, extrinsic and intrinsic pathway, mitochondrial damage, DNA ladders, transglutaminase activity, Apoptosis in Ceanorhabditiselegans- CED 3, CED 4, CED 9 and their roles in Apoptosis - Bax, Bid, BCl2 protein.

Unit V

Human genetics and Population genetics
Population Genetics- type of gene variations, Measuring genetic variations, Hardy Weinberg principle and its deviations. Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders. Medical genetics and genetic disorders.

References


PRACTICAL

AMMB1P01: LABORATORY COURSE - I

Total Lab Hours: 180  Credits: 4

BIOCHEMISTRY

1. Preparation of solutions:
   - Percentage solutions
   - Molar solutions
   - Normal solutions
   - Dilution of Stock solutions

2. Preparation of buffers using the Henderson Hasselbach equation

3. Spectrophotometric experiments:
   - Verification of Beer Lambert’s law
   - Determination of UV-Visible spectrum of compounds
   - Determination of Concentration of molecules from Molar Extinction Coefficient values

4. Chromatographic techniques
   - Separation of amino acids by Paper chromatography (Descending or Ascending)
   - Separation of Plant pigments by Thin Layer Chromatography

5. Extraction of Polysaccharides (Starch, Glycogen), Proteins from appropriate source:
   - Quantification of isolated polysaccharide (Anthrone method), protein (Lowry’s method) and lipids

6. Estimations
   - Quantitative estimation of reducing sugars by Dinitrosalicylic acid method
   - Quantitative estimation of Methionine by Nitroprusside method
   - Saponification value, iodine value, of fat sample
   - Estimation of Cholesterol by Zak’s method

7. Qualitative analysis of Carbohydrate mixtures (a combination of polysaccharide, disaccharide and monosaccharide) following systematic scheme for analysis. (Starch, dextrin, glycogen, glucose, fructose, xylose, galactose, sucrose, maltose, lactose)

PHYSIOLOGY

1. Determination of haemoglobin concentration.
2. Determination of haematocrit.
3. Enumeration of blood cells
   a) Erythrocytes by haemocytometry
   b) Total leukocyte byhaemocytometry
4. Preparation of Blood smears for differential count and cell morphology.
5. Determination of Erythrocyte Sedimentation Rate
6. Determination of bleeding time
7. Determination of blood clotting time

**CELL BIOLOGY AND GENETICS**

1. Study of various stages of mitosis using cytological preparations of onion root tips.
2. Study of various stages of meiosis using cytological preparation of flower buds
3. Karyotype study using cytological preparation of dividing root tip cells of onion
   /photograph/permanent slides
4. Study in the ultra-structure of cell organelles using electron microphotographs pics.
5. Solving genetic problems related to monohybrid, dihybrid ratio and interaction of genes

**References**

SEMESTER II

AMMB205: MOLECULAR BIOLOGY AND GENETIC ENGINEERING

Total Hours: 72               Credits: 4

Unit I

Unit II
Transcription: Prokaryotic transcription – Molecular mechanism. Eukaryotic transcription - Mechanism in detail, inhibitors of transcription.

Unit III
Unit IV

Unit V
Applications of transgenic technology in plant and animals, methods and applications. Gene therapy. Biopharming. DNA chips and microarray, genetic markers.

References
AMMB206: IMMUNOLOGY

Total Hours: 72
Credits: 4

Unit I

Unit II

Unit III
T-cell receptor, T-cell accessory membrane molecules and TCR-CD3 complex, Co-stimulatory signal, Clonal anergy, Signaling pathways by activation of TCR, ITAM, T-cell maturation, activation and differentiation, Cell mediated Immune response, B cell- generation, activation, differentiation, B – cell receptor B-cell coreceptor complex, Humoral Immune response- Antibody formation, Primary and secondary immune response, Clonal selection theory. Cytokines, MHC, HLA typing, MHC-restriction, Antigen processing and presentation, Complement system and Complement activation pathways, regulation of complement activation, Biological effects of complements

Unit IV
Immunology of organ and tissue transplantation, Graft and types, Allograft reaction and GVH reaction, Histocompatibility testing, Immunosuppression, Factors influencing allograft survival, Immunology of malignancy- Tumor antigens, TATA, TSTA, Immune response in
malignancy, Tumor Evasion of the Immune System, Immunotherapy of cancer, LAK cells, TILs, Immunohematology- ABO and Rh blood group system, Immunology of blood transfusion, Hemolytic disease of new born.

**Unit V**

Immunological Tolerance, Autoimmunity, Classification of Autoimmune diseases, Mechanisms of autoimmunity. Inflammation, Hypersensitivity, types of hypersensitivity reactions and their features, Immunodeficiency diseases, primary immunodeficiency and secondary immunodeficiency disease, Immunoprophylaxis, Vaccines – types of vaccines, Routine immunization schedules, DNA vaccine and recent trends in vaccine development.

**Reference**

AMMB207: BIOPHYSICS, BIOINSTRUMENTATION AND BIOINFORMATICS

Total Hours: 72  
Credits: 4

Unit I
Laws of thermodynamics, the concept of enthalpy, entropy and free energy, thermodynamic equilibrium, redox potential, high energy molecules, examples of redox potential in biological system. Membrane systems involved in energy transduction - Mitochondria, chloroplast. DNA - Protein interaction. Lambda repressor and cro binding to DNA. Interactions of transcription factors- HLH, bHLH, Leucine Zipper, Cys-His, Zinc fingers. RNA - protein interactions, DNA-drug Interaction. Ramachandran plot—conformational maps of glycine and other natural amino acids.

Unit II
Microscopy: Light, phase contrast, SEM, TEM, polarization, confocal and interference microscopy, fluorescence microscopy. Introduction to Atomic force microscopy. Principle, methods and applications of polarimetry, cytometry, flow cytometry.

Unit III

Unit IV

Unit V
Bioinformatics: Introduction to bioinformatics, application of data mining in Bioinformatics, Biological databases and search tools, sequence databases, structural data bases, derived and specialized data bases. Three dimensional structure of proteins, prediction of structural
classes, motifs, folds and domains, classification of three dimensional structures in Brookhaven protein data bank (HSSP, SCOP, FSSP, CATH); protein structure prediction, structural alignment methods, homology modelling, dynamical programming, Human brain project. Molecular simulation, rational drug design and docking, applications of bioinformatics.

Reference
Unit I

Unit II

Unit III
Enzymes and Enzyme kinetics: Holoenzyme, apoenzyme, and prosthetic group, mechanism of enzyme action, transition state stabilization, enzyme specificity and types, Enzyme Commission system of classification and nomenclature of enzymes, ribozymes and abzymes. Coenzymes and their functions - NAD, NADP\(^+\), FAD, FMN, lipoic acid, TPP, pyridoxal phosphate, biotin and cyanocobalamin. Measurement and expression of enzyme activity, enzyme assays. Definition of IU, katals, enzyme turnover number and specific activity. Order of the reaction, factors affecting the velocity of enzyme catalyzed reaction, derivation of Michaelis-Menten equation, \( K_m \) value and \( V_{max} \) value and their significance, Lineweaver-Burk plot and its physiological significance; Bi-substrate reactions: classification with examples of each class, reaction mechanisms-random, ordered and ping pong; King-Altman method to determine velocity equations.
Unit IV
Enzyme inhibition and regulation: Reversible and irreversible - examples. Reversible-competitive, noncompetitive and uncompetitive inhibition (with kinetics); Dose response curves of enzyme inhibition; mutually exclusive binding of two inhibitors; structure-activity relationships and inhibitor design; tight binding inhibitors: examples; time dependent inhibition: examples; distinguish between modes of inhibitor interaction with enzymes.
Allosteric enzymes: concerted and sequential models for allosteric enzymes; significance of sigmoidal behaviour, allosteric regulation: example of aspartate transcarbamoylase. Covalently modulated enzymes-reversible and irreversible covalent modifications.Zymogenform of enzymes and zymogen activation; Multienzyme system - mechanism of action of pyruvate dehydrogenase and its role in regulation of metabolic pathways; Isoenzymes-lactate dehydrogenase and creatine phosphokinase.
Unit V
Application of enzymes: immobilisation of enzymes, industrial uses of enzymes: production of glucose from starch, cellulose and dextrants, use of lactase in diary industry, production of glucose fructose syrup from sucrose, use of proteases in food, leather and detergent industry. Diagnostic and therapeutic enzymes.

Reference
PRACTICAL

AMMB2P02: LABORATORY COURSE - II
(Microbiology, Immunology, Molecular Biology and Genetic Engineering)

Total Hours: 180 Credits: 4

MICROBIOLOGY AND IMMUNOLOGY

1. General rules in microbiology laboratory
2. Culture media and it’s preparation
3. Microscopic examination of bacteria in living conditions
   - Wet mount preparation
   - Hanging drop method
4. Staining procedures- Gram’s, Volutin, Spore, Capsule, Negative, Acid Fast, Fungalstaining etc.
5. Cultivation of bacteria, fungi
6. Sterilization methods
7. Study of cultural characteristics and biochemical reaction of bacteria
8. Testing of disinfectants
9. Bacterial growth curve
10. Antibiotic sensitivity tests- disc diffusion, MIC
11. Serological tests for the diagnosis of microbial infections- VDRL, WIDAL, RPR, CRP, ASO
12. Immunodiffusion in gel
13. ELISA

MOLECULAR BIOLOGY AND GENETIC ENGINEERING

1. PAGE- Protein separation
2. Isolation of DNA from different sources- plants and microorganisms.
3. Agarose gel electrophoresis of nucleic acids
4. Isolation of plasmids from bacteria.
5. Estimation of DNA and RNA
6. Polymerase Chain Reaction
7. Restriction enzyme digestion
8. Ligation, Bacterial transformation and blue white screening
9. Comparison of microbial genome size
10. Online sequence analysis, BLAST
11. Phylogenetic analysis

References

SEMESTER III

AMMB309: FOOD MICROBIOLOGY AND QUALITY ASSURANCE
Total Hours: 72
Credits: 4

Unit I
Food and microorganisms- historical developments, microorganisms important in food: molds - general characters, classification and identification, molds of industrial importance. Yeasts and yeast-like fungi - general characters and classification, yeasts of industrial importance. Bacteria: Morphological, cultural and physiological characters important in food bacteriology, genera of bacteria important in food bacteriology. Factors affecting growth of microorganisms.

Unit II

Unit III

Unit IV
Food borne diseases- intoxication and food poisoning, Staphylococcus, Clostridium, Escherichia coli and Salmonella infections and Mycotoxins. Emerging foodborne diseases.

Unit V
Importance and functions of quality control, methods for quality assessment, sterilization control and sterility testing. Sampling and specification of raw materials and

Food laws and regulations- National food legislation/authorities and their role, product certifications (ISI mark of BIS). International organization and agreements-FAO, WHO, concept of codex alimentarius, codex India, world international organization for standardization (ISO). Food safety: General principles, issues and factors affecting food safety, risk management, Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP), Hazard Analysis Critical Control Point System (HACCP), Hurdle effect, quality management system. Shelf life of food products- factors affecting shelf life and methods to check the shelf life. Food Packaging and labelling.

References

AMMB310: INDUSTRIAL MICROBIOLOGY

Total Hours: 72
Credits: 4

Unit I
Pasteur and Fermentation; Scope of industrial microbiology. Isolation and screening of industrially useful microorganisms, Primary and secondary screening, Strain improvement in industrial microbiology; improvement of characters other than product yield. Storage of cultures for repeated fermentations

Unit II
Design of a fermentor, instrumentation and process control; Types of fermenters. Importance of media in fermentation, media formulation and modification. Industrial sterilization, Inoculum development- scaling up of process form shake flask to industrial fermentation

Unit III

Unit IV
Microbial production of Industrial solvents (Ethyl alcohol, Glycerol and acetone butanol); organic acids (Citric acid, Lactic acid, Acetic acid and Itaconic acid) amino acids (Glutamic acid and Lysine), Ergot alkaloids, Vitamins (Vitamin B12, Vitamin B2 and Vitamin C) antibiotics (Penicillin, Steptomycin, Tetracyclin, Griesofulvin), Microbial transformations of steroids.

Unit V

References


AMMB311: ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

Total Hours: 72
Credits: 4

Unit I
Aerobiology - Microbial contamination of air - Sources of contamination, microbial indicators of air pollution. Enumeration of bacteria in air, air sampling devices. Air sanitation. Effect of air pollution on plants and human.

Unit II

Unit III

Unit IV

Unit V
References


PRACTICAL

AMMB3P03: LABORATORY COURSE - III
(Agricultural, Food, Industrial and Environmental Microbiology)
Total Hours: 162 Credits: 4

AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY
1. Isolation and Study of common soil bacteria, fungi and actinomycetes
2. Enumeration of soil microbes by plate culture methods
3. Study of antagonistic activities among soil microbes
4. Estimation of rhizosphere microbial population and calculation of R:S ratio
5. Isolation of non-symbiotic nitrogen fixing bacteria
6. Isolation of *Rhizobium* from nodules of leguminous plants
7. Study of common plant pathogens
8. Isolation of phosphate solubilizing microorganisms
9. Isolation of mycorrhizal spores and its identification
10. Bacteriological examination of air
11. Bacteriological examination of water- SPC, MPNPresumptive, Confirmed and Complete test etc.
12. Winogradsky column
13. Determination of BOD, DO & COD

FOOD AND INDUSTRIAL MICROBIOLOGY
1. Bacteriological examination of food- vegetables, meat products, traditional foods etc
2. Bacteriological analysis of milk, standard plate count, presumptive test for coliforms,methylene blue reduction test and phosphatase test.
3. Cultivation of edible mushrooms.
4. Immobilization technique
5. Crowded plate technique for screening of industrially important microorganisms- microbesproducing enzymes, antibiotics etc.
6. Production of wine
7. Production of citric acid
8. Solid state and submerged fermentation
References


SEMESTER IV

AMMB412: SYSTEMATIC BACTERIOLOGY

Total Hours: 90 Credits: 4

Unit I
Normal bacterial flora of human body; General attributes and virulence factors of bacteria causing infections, Host Parasite relationships.

Unit II
Study of morphology, cultural characteristics, pathogenesis, diagnostic lab tests and prevention of the following bacterial pathogens. Aerobic Cocci- Staphylococci, Streptococci and Neisseriae. Anaerobic cocci- Peptostreptococcus, Peptococcus and Veillonella.

Unit III
Gram positive bacilli- Corynebacterium and Bacillus. Anaerobic rods- Clostridia, Propionibacterium, Bifidobacterium, Bacterioides, Fusobacterium and Leptotrichia.

Unit IV
Gram negative bacilli- Enterobacteriaceae- E.coli, Proteus, Klebsiella, Shigella, Salmonella, Vibrio, Pseudomonas, Haemophilus, Pasteurella, Yersinia, Francisella, Bordetella and Brucella.

Unit V

References


Unit I
Virus infections: Pathophysiology and epidemiology for the diseases caused by Pox virus, Herpes virus, Adeno virus, Entero virus, Myxo virus, Arbo virus, Rhabdo virus, Hepatitis virus, HIV and Miscellaneous viruses.

Unit II

Unit III
Fungal infections in man. Superficial mycoses (Pityriasis Versicolor; Tinea Nigra; Piedra). Cutaneous mycoses (Various forms of Tinea, Microsporum spp., Trichophyton spp., and Epidermophyton floccosum). Subcutaneous mycoses (Mycoticmycetoma, Chromoblastomycosis; Sporotrichosis; Rhinosporidiosis) Systemic Mycoses (Blastomycosis; Paracoccioidomycosis; Histoplasmosis; Coccidioidomycosis). Opportunistic fungal Infections.

Unit IV

Unit V
Protozoa- Medically important protozoans. Entamoebahistolytica, Giardia lamblia, Trichomonas, Trypanosomes, Leishmania, Plasmodium, Toxoplasma and Pneumocystis. Laboratory diagnosis and control of medically important protozons.

Reference


PRACTICAL

AMMB4P04: LABORATORY COURSE - IV

Total Hours: 180  Credits: 4

1. Study of the morphology, staining characters, cultural characters and identification of medically important bacteria *Staphylococci*, *Streptococci*, *E.coli*, *Klebsiella*, *Salmonella*, *Proteus*, *Pseudomonas*, *Vibrio*, *Bacillus*.
2. Isolation and identification of bacteria from mixed culture.
3. Study of common laboratory contaminants.
4. Culture methods for isolation and identification of fungi- KOH mount preparation,
5. Lactophenol cotton blue staining, Slide culture technique etc.
6. Gram staining and Germ tube test of *Candida albicans*
7. Cultivation of viruses in embryonated eggs different routes – harvesting
8. Examination of peripheral blood for malarial parasites
9. Techniques for collection of clinical specimens for microbiological analysis-
10. Macroscopic, microscopic examination of clinical samples.

References

ELECTIVE COURSES

SEMESTER III

AMMB3E01: NANO BIOTECHNOLOGY

Total Hours: 72
Credits: 4

Unit I

Unit II

Unit III
Characterization of nanoparticles – Spectroscopy (UV-Visible and Raman Spectroscopy) Microscopy (TEM, SEM, AFM and STM), Quantitative analysis (EDS, X-Ray Photoelectron Spectroscopy) XRD, FTIR, NMR, TGA and DLS.

Unit IV

Unit V

References:

AMMB3E02: MICROBIAL DIVERSITY AND EXTREMOPHILES

Total Hours: 72  
Credits: 4

Unit I

Unit II
Characteristics and classification of Archaebacteria: Psychrophiles; Thermophiles: Classification, habitats and ecological aspects. Extremely Thermophilic Archaebacteria, Applications of thermoenzymes and psychrophilic archaean extremozymes; Methanogens: Classification, Habitats and applications.

Unit III

Unit IV

Unit V

Reference


AMMB3E03: MARINE MICROBIOLOGY

Total Hours: 72
Credits: 4

UNIT I

UNIT II
Marine Adaptability: Survival at extreme environments – starvation – adaptive mechanisms in thermophilic, alkalophilic, osmophilic and barophilic, psychrophilic microorganisms – hyperthermophiles and halophiles

UNIT III
Marine Microbial Disease: Marine food borne pathogens & Water borne pathogens – Aeromonas, Vibrio, Salmonella, Pseudomonas, etc.

UNIT IV
Marine Pollution: Microbial indicators of marine pollution and control- biofouling, biocorrosion, biofilms and bioremediation

UNIT V

References:

SEMESTER IV

AMMB4E04: CLINICAL MICROBIOLOGY

Total Hours: 90 Credits: 4

Unit I
Microbiology laboratory safety - Biological Safety Cabinets; Biocontainment, Biosafety Levels; Biosafety guidelines- biosafety concerns at the level of individuals, institutions; Laboratory and associated infections. Good microbiological practices. Classification of biological agents based on hazards. Mailing of biohazardous materials.

Unit II
Diagnostic cycle; General concepts for specimen collection, transport and processing. Infection control, Emerging infections, Accreditation of laboratories

Unit III

Unit IV

Unit V
Sero diagnosis of infectious diseases; Routine diagnostic procedures, Molecular techniques in diagnostic microbiology. Laboratory control of antimicrobial therapy.

References


AMMB4E05: MOLECULAR MICROBIOLOGY

Total Hours: 90 Credits: 4

Unit I
Phylogenetic overview of bacteria and archaea, Molecular biology of microbial evolution, rRNA sequence and cellular evolution, Signature sequences and phylogenetic probe. Identification and characterization of microorganisms. Molecular typing methods: Bacterial strain typing, Pulsed Field Gel Electrophoresis, PCR-based microbial typing, Genotyping by Variable Number Tandem Repeats, Multilocus Sequence Typing, Automated Ribotyping, Molecular subtyping for epidemiology.

Unit II
Genome wide approach to study prokaryotic biology, Microbial genome – comparison of genome size, Insight from genome of E.coli, Streptomyces coelicolor and Neurosporacassa. Unculturable bacteria and Metagenomics. Bacterial differentiation and molecular basis of endospore formation, Microbial stress response, Microbes in special habitat: Bacterial biofilm, molecular basis of biofilm development, biofilm dispersal strategies, biofilm in infection, quorum sensing. Extremophiles, molecular adaptation to extreme environment. Endophytes – metabolite diversity.

Unit III

Unit IV
Microbial production of recombinant proteins : expression, purification and applications, Microbes in plant transformation, Agrobacterium tumefaciens T-DNA transfer process, Manipulation of Agrobacterium for genetic engineering, vectors for Agrobacterium mediated transformation, Microbial production of plant metabolites; engineering E.coli for the production of curcumin. Combinatorial and engineered biosynthesis, Microbial polketides and their applications.
References


Unit I

Unit II

Unit III

Unit IV
Environmental pollution- Air: Natural and anthropogenic source of pollution, Primary and Secondary pollutants, Methods of monitoring and control of air pollution, Effects of pollutants on human beings, plants, animals, material and on climate, Acid rain, Air Quality standards. Water: Types, Sources and consequences of water pollution, Physio-chemical and Bacteriological sampling and analysis of water quality, Soil: Physio-chemical and Bacteriological sampling as analysis of soil quality, Soil pollution- Control, Industrial waste effluents, and heavy metals. Their interaction with soil components, Noise: Sources of noise pollution, Noise control and battement measures. Impact of noise on human health. Radioactive and thermal Pollution. Bioremediation- Strategies for bioremediation,
Biosensors, biological indicators of pollution and monitoring, Detoxification of hazardous chemicals, mycotoxins. Biological weapons.

Unit V

References