Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Ref: RU/FS/BT/PG/2017/001 **Dated: 06.05.2017**

Department of Biotechnology

Minutes of Meeting

Boards of Studies

A meeting of Boards of Studies of M.Sc. Biotechnology, Department of Biotechnology held on 06.05 2017 at 12:30 PM in Dean Office. The following members were present:

1. Dr. Ajay Kumar — Chairperson
2. Dr. Vivek Srivastava — Member
3. Mr. Anjani Kumar Srivastava — Member
4. Prof. (Dr.) Nand Lal — External Member
5. Er. Vishal Kumar Srivastava — External Member

Agenda:

1. Action Taken Report (ATR) on Minutes of Previous Meeting.

The BOS committee confirmed the minutes of the BOS meeting held on 26.05.2016.

2. Review of the existing programs and their curricula

S. No.	Item No.	Existing	Recommendation /Action Taken
1	RU/FS/BT/UG/PG/2014 /001 To consider the revised evaluation scheme for M.Sc . Biotechnology students admitted in the session 2017-18	• In existing evaluation scheme for the said batch, total credits = 80. The following changes were proposed: The following subjects should be removed • **MBT-101** Biomolecules • **MBT-152** Biophysical tools and Techniques Lab • **MBT-203** Intermediary	The BOS approved the revised evaluation scheme for M.Sc Biotechnology students admitted in the session 2017-18 and following recommendation were accepted: • The total course credit requirement were revised to 82 • **MBT-113** Biochemistry and **MBT-162** Biochemistry lab, theory and practical were introduced in I[st]

		Metabolism • **MBT-251** Biochemistry and Molecular Biology lab • **MBT-401** Genetic Engineering Lab • **MBT-402** Environmental Biotech Lab • Departmental Elective subjects should be introduced in IVth semester.	Semester. • **MBT-213** Genetics and **MBT-261** Molecular biology Laboratory were introduced in the second semester. • **MBT-411** Recombinant DNA Technology, **MBT-412** Microbial Biotechnology, **MBT-413** Medical Biotechnology, **MBT-414 to MBT-415** Departmental elective subjects were introduced in IVth semester. • **MBT-414** Environmental Biotechnology, **MBT-415** Genomics & Proteomics were offered as Departmental elective subjects in IVth semester.

3. **Consideration of the curricula of the new programs**

S. No.	Item No.	Feedback from Faculty/subject experts/Industries	Recommendation /Action Taken
1	Report of feedback on curriculum by stakeholder	• Faculty suggested that that we should include Medical Biotechnology, Microbial Biotechnology, and Genomics & Proteomics. Also the syllabus must be taken to more depth and	• Medical Biotechnology, Microbial Biotechnology, and Genomics & Proteomics are included in Departmental electives. Syllabus of these electives are in depth and explicitly written/defined. • Communication skills, personality

		explicitly written/defined. • Faculty suggested that the department should focus on improving communication skills, personality development, self-motivation and confidence and good mentoring.	development, self-motivation and confidence and good mentoring are the areas discussed with Training and Placement department. So that they provide proper guidance in these field.

The meeting concluded with a vote of thanks to the chair.

Date of the Next Meeting: to be decided and conveyed later

(Chairperson)

Signature: .....

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1..... 2.....

Name: Dr. Vivek Srivastava Er. Anjani Kumar Srivastava

Date:

External Members

Signature: 1..... 2.....

Name: Prof. Nand Lal Er. Vishal Kumar Srivastava

Date:

Encl.: Recommended Curricula attached for consideration and approval.

CC:

1. Dean
2. Registrar Office

M.Sc. Biotechnology

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO 1: To develop strong student competencies in biotechnology and its applications in a technology-rich, interactive environment.

PEO 2: To develop strong student skills in research, analysis and interpretation of problems and information relevant to modern biology.

PEO 3: To prepare the students to successfully compete for employment in biotech-based inquiry and development sectors, industrial sectors and teaching, and to provide a broad scope of experience in research methods, data analysis to match the industrial demands.

PEO 4: The aim of this class is to offer detailed knowledge of techniques applied in biological research and industries.

PEO 5: Understanding biotechniques is essential to strengthen the knowledge of the candidate desired to operate in the area of biotechnological research, development and fabrication.

PEO 6: Learning biotechniques is important for students of all fields of life sciences.

PROGRAMME OUTCOMES (PO)

PO1: Possess the modern molecular Biological and Technical knowledge needed to support Biotechnology research activities.

PO 2: Demonstrate their ability to function effectively in teams.

PO3: Study the use of living organisms and Bioprocess in genetic engineering, Medicine, Agriculture and results in all kinds of Bio products from GMO food to carry out Gene therapy to Auto Immune Disease.

PO 4: They also explore Bioinformatics in the discipline of Molecular Biology.

PO 5: Bioinformatics methods are widely used for Gene Mapping, DNA analysis and Protein Samples. Biotechnology and Bioinformatics do a great favour to evolutionary biology and offer new vistas for Drug design and discovery.

PO 6: Students gain sound professional Ethics, Leadership and consensus building skills relevant to Biotechnology aspects of business endeavor.

PO 7: Students become an excellent researcher or Scientist or Teacher in Biotechnology field to discover unique products for societal needs with proper Ethical statute.

PO 8: Apply knowledge and science in the conception and development of solutions for problems relevant to advanced biology to provide the needs of biotech industries.

PO 9: Become professionally trained in the field of molecular biology, recombinant DNA engineering, microbial technology, animal and plant tissue culture, Bioinformatics etc.

PO 10: Excel in the research related to biotechnology and quality control of biologicals.

PO 11: Demonstrate highest standards of critical, interpersonal and communication skills as easily as a dedication to lifelong learning.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1: Demonstrate their ability to apply Biotechnological research strategies to solve the Global Environmental Problems like Climate change, Ozone Depletion, Acid Rain, Industrial waste etc.

PSO 2: Exhibit their knowledge on Industrial regulations and Environmental safety principles in biotechnology industries.

PSO 3: Work collaboratively on projects involving typical business timeline.

PSO 4: Integrate the basic principles of analytical techniques for the implementation of such technique to facilitate the development of Bio Pharma products viz. Drugs, Antibiotics, Hormones, Vaccines.

PSO 5: Familiar with the principles underlying the relevant compounds and their clinical relevance.

PSO 6: Expert in using online database understanding, creation and testing of scientific hypothesis and critical evaluation of experimental data.

[Approved by Academic Council in its meeting dated / / 2014 and by Executive Council in its meeting dated / /2014]

RAMA UNIVERSITY

Ordinances for

Master of Science in Biotechnology

RAMA UNIVERSITY, KANPUR

Ordinances for

Master of Science in Biotechnology

[Approved by Academic Council in its meeting dated / /2014 and by

Executive Council in its meeting dated / /2014]

1. Admission

1.1. Admission to M.Sc. Biotechnology First year in I[st] semester will be made as per the rules prescribed by the Academic Council of the Rama University, Kanpur.

1.2. Admission on migration of a candidate from any other University to the University is permitted.

2. Eligibility for Admissions:

2.1. Admission to M.Sc. Biotechnology First Year:

Candidates who have passed B.Sc. Biotechnology/Biosciences/Agricultural are eligible for admission to first year of 2 year M.Sc. Biotechnology. Courses offered by Faculty Sciences affiliated to Rama University, Kanpur.

3. Attendance

3.1 Every student is required to attend all the lectures, tutorials, practicals and other prescribed curricular and co-curricular activities. The attendance can be condoned up to 25% on medical grounds or for other genuine reasons beyond the control of students.

3.2 A further relaxation of attendance up to 15% for a student can be given by Dean provided that he/she has been absent with prior permission of the Head of Department for the reasons acceptable to him.

3.3 No student will be allowed to appear in the end semester examination if he / she do not satisfy the overall average attendance requirements of Clause Nos. 3.1, and 3.2. and such candidate(s) shall be treated as having failed and will be further governed by clause no. 4.1 & 4.2.

3.4 The attendance shall be counted from the date of admission in the college or start of academic session whichever is later.

4. Duration of Courses

4.1 Total duration of the M.Sc. Biotechnology Course shall be 2 years, each year comprising of four semesters. Each semester shall normally have teaching for the 90 working days or as prescribed by UGC from time to time.

4.2 A candidate, who has failed twice in first year due to any reason (either due to his/her non-appearance or he/she being not permitted to appear in semester examinations) shall not be allowed to continue his/her studies further subject to clause 9.

5. Curriculum:

5.1 The 2 years curriculum has been divided into 4 semesters and shall include lectures, tutorials, practicals, seminars and projects etc. in addition to industrial training and educational tour etc. as defined in the scheme and executive instructions issued by the University from time to time.

5.2 The curriculum will also include such other curricular, co-curricular and extra- curricular activities as may be prescribed by the University from time to time.

6. Examination:

6.1 The performance of a student in a semester shall be evaluated through continuous evaluation and end semester examination. The continuous evaluation shall be based on Mid Term Examination, assignments/tutorials, quizzes/viva-voce and attendance. The marks for continuous evaluation (Sessional marks) shall be awarded at the end of the semester. The end semester examination shall be comprised of written papers, practicals and viva-voce, inspection of certified course work in classes and laboratories, project work, design reports or by means of any combination of these methods.

6.2 The distribution of marks for sessional, end semester theory papers, practicals and other examinations, seminar, project, industrial training shall be as prescribed.

6.3 The marks obtained in a subject shall consist of marks allotted in end semester theory paper, practical examination and sessional work.

6.4 The minimum pass marks in each theory subject (including sessional marks) shall be 40% with a minimum of 30% marks in each theory paper in the end semester examination. If there is no provision of sessional marks in any subject, the minimum pass marks in that subject shall be 30% in the end semester examination.

6.5 The minimum pass marks in a project/practical subject (including sessional marks if any) shall be 50%.

6.6 A candidate, in order to pass, must secure 50% marks in the aggregate in a particular academic year inclusive of both semesters of the academic year subjected to conditions as clause 8.2(a).

6.7 The minimum pass marks in Seminar, Industrial Training and Educational Tour, Viva-Voice etc shall be 50%.

7. Promotion:

7.1 A candidate satisfying all the requirements under clause 7 shall be promoted to the next academic year of study.

7.2. (a) A candidate shall be eligible for provisional promotion to the next academic year of study provided :

(i) He/she fails to satisfy the requirements of clause 6.4, 6.5 and 6.7 in not more than 6 theory subject and 2 practical/ project subjects on the basis of combined result of both semester examinations of a particular academic year.

(ii) He/she fails to satisfy the requirements of clause 6.4, 6.5 and 6.7 (theory and/or practical/ project subjects) in not more than 5 theory subjects and 2 practical/project subjects in addition he/she fails to satisfy requirement of clause 6.6 (aggregate marks) in the combined result of both semester examinations of a particular academic year. In such a case aggregate marks shall be treated as one theory subject.

(b) If a candidate satisfies the requirement of clauses 6.4, 6.5 & 6.7 but fails to satisfy the requirement of clause 6.6, he/she shall be eligible for provisional promotion with carry over. He/she may choose up to a maximum of any four theory papers of that particular academic year as per his/her choice to pass the examination of that year.

7.3 A candidate shall not be promoted to third year unless he/she passes all the subjects of first year. Similarly, a candidate shall not be promoted to fourth year unless he/she passes all the examinations of second year.

7.4 All other candidates who do not satisfy conditions laid down in clause 7 shall be declared fail and shall be required to repeat the whole academic year after taking re- admission. This facility is, however, subject to the time limits stipulated in clause-4.

8. Carryover System:

8.1(a) A candidate who satisfies the requirements of clause 7.2 (a) will be required to appear in those theory papers / practicals in which he/she failed. However, a candidate of first year will be allowed to appear in the second semester examination in those theory/ practical subjects in which he/she failed in the first

semester examination, provided examination of those theory/practical subjects are held in second semester.

(b) A candidate satisfying clause 7.2 (b) shall be required to exercise his/her choice up to a maximum of five theory papers in which he/she desires to appear in the examination to fulfill the requirements of clause 6.6. He/she shall inform the college about his/her choice within 15 days after the start of new session.

8.2 The highest marks secured in any subject in various attempts (end semester and carryover examinations) shall be considered.

9. Ex-studentship:

9.1 A candidate opting for ex-studentship shall be required to appear in all the theory & practical subjects in the end semester examinations of both semesters of the same academic year. However, the marks pertaining to Sessional, Industrial Training, and Seminar shall remain the same as those secured earlier.

9.2 A candidate opting for ex-studentship shall be required to apply to the faculty of Sciences by paying only examination fee within 15 days from the start of new session.

10. Re-admission:

A candidate may be allowed for re-admission provided he/she satisfies one of the following conditions:

10.1 A candidate is declared fail.

10.2 A candidate did not appear in a semester examination / or he/she was not granted permission to appear in the examination.

10.3 A candidate has been detained by the department and subsequently has been permitted to take re-admission.

10.4 A candidate as an ex-student passed the examination of the academic year or qualified for carryover system.

10.5 A candidate promoted with carry over subjects and he/she opted for re- admission.

11. Results:

11.1 The result of a candidate shall be declared on the basis of performance of both semesters of the same academic year. However, a final year student, who is not permitted in any one of the final year semester examinations due to shortage of attendance, will be permitted in that particular semester of the next academic session to study as a regular student and appear at that semester examination.

12. Award of Division: The division shall be awarded on the basis of final year result.

12.1 Calculation of Grade Point and Grade Point Average

Relative grading shall be adopted at the Faculty of Engineering & Technology, Rama University. The list of letter grades, the grade points associated with them are given below:

Grade	Grade Point
A^+	10
A	9
B	8
C	7
D	6
E	5
F	4

In order to arrive at alphabet grades, the total marks in a particular course for all the students pursuing the course are tabulated in the descending order (equivalently a histogram).

The performance of the course is analyzed in terms of the highest, lowest and the average marks and the dividing lines between the clusters of students. Gaps and dips between the clusters and the nature of the clusters guide in drawing the dividing lines between the grades. In a normal class of large size, the C grade usually covers the average performance. This is, however not a hard and fast rule and exceptions may arise in case of small classes, skewed histogram etc. Borderline cases may be considered individually on the basis of regularity and the attendance, class room discussions, progressive good performance throughout the semester, etc.

12.2 Calculation System of Semester Grade Point Average:

- Computation of the Semester Grade Point Average (SGPA) and Cumulative Performance Index (CPI):

  The SGPA is an indicator of the overall academic performance of a student in all the courses he/she has registered during a given semester. It is computed as follows: If the grades awarded to a student are G_1, G_2 etc in courses with corresponding credits C_1, C_2 etc, the SGPA is given by:

$$SGPA = \frac{C_1 \times G_1 + C_2 \times G_2 + \cdots + C_n \times G_n}{C_1 + C_2 + \cdots + C_n}$$

- The CPI indicates the overall academic performance of a student in all the courses registered up to and including the latest completed semester/summer term. It is computed in the same manner as the SGPA, considering all the courses (say, n) and is given by:

$$CPI = \frac{\sum_{i=1}^{n} C_i \times G_i}{\sum_{i=1}^{n} C_i}$$

- Percentage conversion of CPI :

$$Percentage\ of\ marks = CPI \times 10$$

- Students should get a minimum grade E in each subject with 5CPI to clear the semester.
- CPI conversion

≥8 CPI	**Ist division with honours**
≥6 CPI	**Ist division**
≥5 CPI	**IInd division**
<5 CPI	**Fail**

12.3 If a candidate passes all examinations in first attempt without grace and secures 8CPI or more marks, he/she shall be placed in FIRST DIVISION WITH HONOURS and the candidates at first two top positions amongst First Div. with Honours only will be awarded medals viz. Gold and Silver respectively in order of merit.

13. Award of Rank:

On the basis of final year result, the top ten candidates in each branch shall be awarded rank according to their merit provided they pass all the examinations in first attempt.

14. Grace Marks:

14.1 A candidate may be awarded grace marks up to a maximum of total 10 marks, in maximum three subjects but not more than four marks in any subject including theory papers, practicals, project, seminar, industrial training and/ or aggregate marks in each academic year provided he/she can be declared to have passed the academic year by the award of these marks.

14.2 The grace marks shall not be added to the aggregate marks.

15. Scrutiny and Revaluation:

15.1Scrutiny shall be allowed in three theory papers.

15.2Revaluation of theory/practical papers is not permitted.

16. Unfair means:

Cases of unfair means shall be dealt as per the rules of the University and The U.P. Public Examination (Prevention of Unfair means) Act if any in prevalence.

17. Award of Sessional Marks:

Sessional marks for theory subjects, practicals and project shall be awarded as will be prescribed and at present the break-up of sessional marks shall be as follows:

Evaluation Scheme:

- **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

1. Attendance: 5 Marks
2. Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks
b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

- **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks
Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks
b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 50 Marks

Make-up test may be held only for those students who could not appear in any one of mid-term class tests due to genuine reasons for which the prior permission from the Head of Department was taken. Make up test shall ordinarily be held about two weeks before the semester examination. The syllabus for the make-up test shall be the whole syllabus covered by the subject teacher upto that time.

18. Award of Seminar, Industrial Training, Educational Tour Marks at Department level:

18.1The marks of Seminar, Major project shall be awarded on the following basis:

Criteria	Internal	External	Total
Project Report	200	50	250
Viva Voce	100	50	150
Total	**300**	**100**	**400**

18.2 The marks in Seminar, Industrial Training and Educational Tour shall be awarded by a committee consisting of following members:

(i) Head of the Department or his/her nominee.

(ii) Concerned Officer – Incharge.

(iii) Senior Faculty Member of the department nominated by the Head of Department.

19. Cancellation of Admission:

The admission of a student at any stage of study shall be cancelled if:

(i) He / She is not found qualified as per UGC/AICTE / State Government norms and guidelines or the eligibility criteria prescribed by the University.

or

(ii) He / She is found unable to complete the course within the stipulated time as prescribed in clause 4.2

or

(iii) He / She are found involved in creating indiscipline in the Faculty of Sciences or in the University.

20. The Academic Council shall have the power to relax any provision provided in the ordinance in any specific matter/situation subject to the approval of Executive Council of the University & such decision(s) shall be reported to the Chancellor of the University.

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

EVALUATION SCHEME

M.Sc. Biotechnology

[Effective from the Session 2017-18]

1st & 2nd Year

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Course Detail and Evaluation Scheme

(Effective from the Session 2017-18)

M.Sc. Biotechnology

First Year (Semester-I)

S.N.	Subject Code	Subject Name	Period			Evaluation Scheme			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory subjects										
1	MBT-111	Microbiology	3	1	0	20	20	60	100	4
2	MBT-112	Molecular Cell Biology	3	1	0	20	20	60	100	4
3	MBT-113	Biochemistry	3	1	0	20	20	60	100	4
4	MBT-114	Biophysical Tools and Techniques	3	1	0	20	20	60	100	4
Practicals / Project										
5	MBT-161	Molecular Cell & Microbiology Lab	0	0	2	30	20	50	100	2
6	MBT-162	Biochemistry Lab	0	0	2	30	20	50	100	2
Total			**12**	**4**	**4**	**140**	**120**	**340**	**600**	**20**

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

Evaluation Scheme:

- **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

1. Attendance: 5 Marks
2. Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks

b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

- **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks

Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks

b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 50 Marks

Convener

Signature: .....

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature:	1.....	2.....
Name:	Dr. Vivek Srivastava	Er. Anjani Kumar Srivastava
Date:		

External Members

Signature:	1.....	2.....
Name:	Prof. Nand Lal	Er. Vishal Kumar Srivastava
Date:		

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Course Detail and Evaluation Scheme

(Effective from the Session 2017-18)

M.Sc. Biotechnology

First Year (Semester-II)

S.N.	Subject Code	Subject Name	Period			EVALUATION SCHEME			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory subjects										
1	MBT-211	Molecular Biology	3	1	0	20	20	60	100	4
2	MBT-212	Enzymology	3	1	0	20	20	60	100	4
3	MBT-213	Genetics	3	1	0	20	20	60	100	4
4	MBT-214	Biostatistics & Bioinformatics	3	1	0	20	20	60	100	4
Practicals / Project										
5	MBT-261	Molecular Biology Lab	0	0	2	30	20	50	100	2
6	MBT-262	Biostatistics And Bioinformatics Lab	0	0	2	30	20	50	100	2
Total			**12**	**4**	**4**	**140**	**120**	**340**	**600**	**20**

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

Evaluation Scheme:

- **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

1. Attendance: 5 Marks

2. Assignments/Quiz / Seminar/Term paper /Project: 15Marks

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks

b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

- **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks

Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks

b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 50 Marks

Convener

Signature: .....

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature:	1.....	2.....
Name:	Dr. Vivek Srivastava	Er. Anjani Kumar Srivastava
Date:		

External Members

Signature:	1.....	2.....
Name:	Prof. Nand Lal	Er. Vishal Kumar Srivastava
Date:		

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Course Detail and Evaluation Scheme

(Effective from the Session 2017-18)

M.Sc. Biotechnology

Second Year (Semester-III)

S.N.	Subject Code	Subject Name	Period			EVALUATION SCHEME			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory Subjects										
1	MBT-311	Immunology	3	1	0	20	20	60	100	4
2	MBT-312	Plant Biotechnology	3	1	0	20	20	60	100	4
3	MBT-313	Animal Cell Science & Technology	3	1	0	20	20	60	100	4
4	MBT-314	Bioprocess Engg. & Fermentation Technology	3	1	0	20	20	60	100	4
Practicals / Project										
5	MBT-361	Tissue Culture Lab	0	0	2	30	20	50	100	2
6	MBT-362	Immunology Lab	0	0	2	30	20	50	100	2
Total			**12**	**4**	**4**	**140**	**120**	**340**	**600**	**20**

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

Evaluation Scheme:

- **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

1. Attendance: 5 Marks
2. Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks

b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

- **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks

Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks

b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 50 Marks

Convener

Signature: .....

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature:	1.....	2.....
Name:	Dr. Vivek Srivastava	Er. Anjani Kumar Srivastava
Date:		

External Members

Signature:	1.....	2.....
Name:	Prof. Nand Lal	Er. Vishal Kumar Srivastava
Date:		

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Course Detail and Evaluation Scheme

(Effective from the Session 2017-18)

M.Sc. Biotechnology

Second Year (Semester-IV)

S.N.	Subject Code	Subject Name	Period			EVALUATION SCHEME			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory Subjects										
1	MBT-411	Recombinant DNA Technology	3	1	0	20	20	60	100	4
2	MBT-412	Microbial Biotechnology	3	1	0	20	20	60	100	4
3	MBT-413	Medical biotechnology	3	1	0	20	20	60	100	4
4	MBT-414/MBT-415	Departmental Elective*	3	1	0	20	20	60	100	4
Practical / Project										
5	MBT-461	Project Work & Presentation	0	0	12	100	-	100	200	6
Total			**12**	**4**	**12**	**340**	**80**	**340**	**600**	**22**

Departmental Electives : *MBT-414-Environmental Biotechnology, MBT-415 Genomics and Proteomics

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

Evaluation Scheme:

- **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

- Attendance: 5 Marks
- Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks

b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

- **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks

Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks

b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 50 Marks

Convener

Signature: .....

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1..... 2.....

Name: Dr. Vivek Srivastava Er. Anjani Kumar Srivastava

Date:

External Members

Signature: 1..... 2.....

Name: Prof. Nand Lal Er. Vishal Kumar Srivastava

Date:

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

SYLLABUS

M.Sc. Biotechnology

[Effective from the Session 2017-18]

1st & 2nd Year

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

First year – Semester-I

MBT-111: MICROBIOLOGY

L T P

3 1 0

Credit: 4

OBJECTIVES:

Our curriculum is designed to educate our majors in a variety of important microbiological disciplines, as well as to promote and develop skills and competencies that have enduring value beyond the classroom.

OUTCOME:

Students will be able to:

1.Define/explain within multiple microbiology disciplines the core theories and practices;

2.Describe/explain the processes used by microorganisms for their replication, survival, and interaction with their environment, hosts, and host populations;

3.Demonstrate practical skills in the use of tools, technologies and methods common to microbiology, and apply the scientific method and hypothesis testing in the design and execution of experiments.

CONTENTS:

Unit 1: **8 Hours**

History, development and scope of microbiology: Doctrine of spontaneous generation; controversy over spontaneous generation; contribution of Antony Van Leeuwenhoek, Lazzaro Spallanzani, John Tyndall, Louis Pasteur, Joseph Lister, Iwanowsky, Robert Koch in the development of microbiology, Microbiology in the 20th century, Different microbes and Microbial classification.

Unit 2: **8 Hours**

Structural and functional relation of prokaryotes. Cell wall, cell membrane, capsule, flagella, fimbriae, pili, Tactic movements, storage granules, metabolism of volutin (polyphosphates), glycogen, poly-hydroxy alkanoates, endospore structure and, process of sporulation and regeneration. Microbial genetics (transformation, conjugation, and transduction) Plasmids: F plasmids, R plasmids, Col plasmids etc., bacterial Transposons

Unit 3: **8 Hours**

Microbial Growth: definition and measurement of growth, generation time, arithmetic and exponential growth, Batch growth curve, continuous and synchronous culture, factors affecting microbial growth- nutrients, pH, Temp., Oxygen etc.

Unit 4: **8 Hours**

Microbial control: Methods of sterilization, mechanisms of control (physical, chemical, and radiation etc), biocontrol. Concept of chemotherapy: chemotherapeutic agents (antibiotics, drugs, medicines etc), mechanisms of action. Drug resistance.

Unit 5: **8 Hours**

Application of microbiology: Microbial decomposition of organic matter - cellulose, hemicelluloses, and lignin. Degradation of pesticides: Xenobiotics, Plastics, biodegradable plastics, and biopesticides. Microbiology of water, algal bloom, waste water treatment, biogas generation. Host-microbe interaction: rhizosphere, phyllosphere, mycorrhiza, PGPR, siderophores in relation to rhizobacteria

Text/Reference Books:

1. Pelczar MJ Jr., Chan ECS and Kreig NR., Microbiology, 5thEdition, Tata McGraw Hill, 1993.
2. Maloy SR, Cronan JE Jr., and Freifelder D, Microbial Genetics, Jones Bartlett Publishers,Sudbury, Massachusetts, 2006.
3. Crueger and A Crueger, (English Ed., TDW Brock); Biotechnology: A textbook of Industrial Microbiology, Sinaeur Associates, 1990.
4. G Reed, Prescott and Dunn's, Industrial Microbiology, 4th Edition, CBS Publishers, 1987.
5. M.T. Madigan and J.M. Martinko, Biology of Microorganisms, 11thEdition, Pearson Prentice Hall, USA, 2006

MBT-112: MOLECULAR CELL BIOLOGY

L T P **Credit-4**

3 1 0

OBJECTIVES:

Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles

OUTCOME:

At the end of this course students should be able to

1. Exhibit a knowledge base in genetics, cell and molecular biology, and anatomy and physiology
2. Demonstrate the knowledge of common and advanced laboratory practices in cell and molecular biology
3.

CONTENTS:

Unit 1: **8 Hours**

Origin of biomolecules, the ancient reducing environment of earth, origin of oxygen, origin of prokaryotes and eukaryotes, origin of mitochondria and chloroplast, Miller-Urey experiment, cell theory.

Unit 2: **8 Hours**

The structural and Functional relation of cellular organelles: Plasma membrane, cell wall, cytoskeleton their structural organization and extra cellular matrix. Mitochondria, chloroplast, endoplasmic reticulum, Golgi-bodies, ribosome, lysosomes and carbohydrate containing bodies, nucleus, and other organelles and their organization.

Unit 3: **8 Hours**

Biological membranes: Physicochemical properties of cell membranes and their structural constitution. Transport of nutrients across the membranes –simple, passive, facilitated diffusion, Protein targeting and sorting- Post translational import of proteins to mitochondria, lysosomes, nucleus.

Unit 4: **8 Hours**

Cellular responses (various types of chemicals) in bacteria, plants and animals, Mechanism of signal transduction, signalling through G- protein coupled receptors, Cell cycle (mitosis and meiosis) molecular events and, cell cycle control.

Unit 5: **8 Hours**

Cellular basis of differentiation and development – cell division, gametogenesis and fertilization, cell differentiation, cleavage, morula, blastula, gastrulation and neurulation etc. morphogenetic determinants in egg cytoplasm.

Text/Reference Books:

1. Lodish et al., Molecular cell Biology, 4thEdition, W.H. Freeman & Company, 2000.
2. Smith & Wood, Cell Biology, 2nd Edition, Chapman & Hall, London, 1996.
3. Watson et al., Molecular Biology of the gene,5th Edition, Pearson Prentice Hall. USA, 2003.
4. B. M. Turner, Chromatin & Gene regulation, 1st Edition, Wiley-Blackwell, 2002.
5. Benjamin Lewin, Gene IX, 9th Edition, Jones and Barlett Publishers, 2007.

MBT-113: BIOCHEMISTRY

L	T	P	Credit-4
3	1	0	

OBJECTIVES:

The course aims to provide students with a basic understanding of:

1. Demonstrate knowledge and understanding of the principles that govern the structures of macromolecules and their participation in molecular recognition
2. The principles of bioenergetics and enzyme catalysis
3. The chemical nature of biological macromolecules, their three-dimensional construction, and the principles of molecular recognition

OUTCOME:

Students will learn about:

1. How chemical and molecular processes take place in and between cells. Your understanding of these processes will sufficient depth to enable you to describe and explain both the processes and their effect on the properties of living organisms.
2. The most important molecular or mesoscopic methods used today to expand our biological and medical knowledge, or to increase our understanding of biomaterials.

CONTENTS:

Unit 1: **8 Hours**

Water - Structure, unusual properties, role in biological processes. Ionization of Water, pH scale. Buffers and buffering mechanism. Energy, energy flow cycle; Structure and properties of ATP; High energy compounds, Role of water as solvent, pH, pKa, Henderson Hasselbalch equation. Biological buffers - bicarbonate buffer, phosphate buffer.

Unit 2: **8 Hours**

Carbohydrates – classification, structure and functions of monosaccharides, disaccharides and polysaccharides. Ring structure and mutarotation, Anomer and Epimer. Metabolism of carbohydrates & its regulation- Glycolysis, Gluconeogenesis, TCA, ETS, Pentose Phosphate Pathway, Glyoxylate cycle. Regulatory mechanism of glycolysis, Disorder of carbohydrate metabolism,

Unit 3: **8 Hours**

Fats and lipids – Classification, structure and function: Simple, Compound lipids, Biological Importance of Choline, Lecithin, lipoproteins, VLDL, LDL, HDL. Biosynthesis of fatty acids. Elongation of fatty acids. Unsaturation of fatty acids. Regulation of fatty acids. Beta–oxidation, Comparison of fatty acid biosynthesis and fatty acid degradation. Ketone bodies. Disorders of lipid metabolism.

Unit 4: **8 Hours**

Amino acids and proteins - Classification & structure of amino acids. Peptide bond formation, Ramachandran plot. Primary, secondary, tertiary & quaternary structure of proteins. Metabolism- Biosynthesis of amino acids from intermediates of Citric Acid Cycle & other major pathways. Biodegradation of amino acids: Deamination, transamination. Urea Cycle. Disorder of amino acids metabolism.

Unit 5: **8 Hours**

Purines and pyrimidines – Structure and properties. Different forms of DNA (A, B, C, D and Z) and RNA (mRNA, rRNA, tRNA). Nucleotide biosynthesis: De-novo and Salvage pathway for purines and pyrimidines, Ribonucleotide reductase, conversion of nucleoside mono phosphate to nucleoside di and tri phosphate. Nucleotide catabolism, disorders of nucleotide metabolism: Lesch-Nyhan Syndrome, Gout, Adenosine deaminase deficiency.

Text/Reference Books:

1. V.Voet and J.G.Voet, Biochemistry, 3rd edition, John Wiley, New York, 2004.
2. A.L. Lehninger, Principles of Biochemistry, 4thedition, W.H Freeman and Company, 2004.
3. L. Stryer, Biochemistry, 5thedition, W.H. Freeman and Company, 2002.

MBT-114: BIOPHYSICAL TOOLS AND TECHNIQUES

L	T	P	Credit-4
3	1	0	

OBJECTIVES:

Biophysical Techniques explains in a readily accessible way the basics of the various methods available including those used to study molecular structure, cell structure, and dynamic interactions so that students can understand the principles behind the different methods used.

OUTCOME:

1. A Master's degree will give you a broad foundation in biophysics with particular focus on radiation physics. In particular, this includes learning about the structure and function of important biomolecules and cellular systems.
2. Students will also learn about methods for measuring the effects of radiation on these models. Students will learn fundamental scientific working methods, how to work independently on a large-scale project, and you will gain experience in producing a clear, well-structured, critical written presentation.

CONTENTS:

Unit 1: **8 Hours**

Principles and applications of light Microscope: Bright field, Dark field, phase contrast, fluorescence. Electron microscopy: scanning and transmission, flow cytometry.

Unit 2: **8 Hours**

Theory and Principles ofchromatography, TLC and Paper chromatography; Chromatographic methods for macromolecule separation - Gel permeation, Ion exchange, Hydrophobic, Reverse-phase and Affinity chromatography; HPLC, FPLC, GLC.

Unit 3: **8 Hours**

Theory and application of Polyacrylamide gel electrophoresis and Agarose gel electrophoresis; Capillary electrophoresis; 2D Electrophoresis; Isoelectric focusing; Disc gel electrophoresis; Gradient electrophoresis; Pulsed field gel electrophoresis, SDS-PAGE.

Unit 4: **8 Hours**

Basic principles; Mathematics and theory (RCF, Sedimentation coefficient etc); Types of centrifuge - Microcentrifuge, High speed & Ultracentrifuges, Preparative, differential and density gradient centrifugation.

Unit 5: **8 Hours**

NMR: basic principles; chemical shift; Use of NMR in studying protein structure and X-ray diffraction. PMR, ESR, Measurement of stable isotopes: Falling drop method and Mass spectrometry, applications of radioisotopes in biology. UV, Visible and Raman Spectroscopy, Mass spectrometry, CD and ORD.

Text/Reference Books:

1. Freifelder D., Physical Biochemistry, Application to Biochemistry and Molecular Biology, 2nd Edition, W.H.Freeman & Company, San Fransisco, 1982.
2. Keith Wilson and John Walker, Principles and Techniques of Practical Biochemistry, 5th Edition, Cambridge University Press, 2000.
3. D. Holme & H. Peck, Analytical Biochemistry, 3rd Edition, Longman, 1998.

R. Scopes, Protein Purification - Principles & Practices, 3rd Edition, Springer Verlag, 1994

MBT-161: CELL & MICROBIOLOGY LAB

L T P **Credit: 1**

0 0 2

Cell Biology Lab

1. Mitotic metaphase chromosome preparation from bone marrow of mouse/rat.
2. Cell motility and flagellar staining.
3. Microscopic studies of cell organelles.
4. Isolation of neutrophils and demonstration of phagocytosis.
5. Determination of osmotic fragility of RBC membrane.
6. Vital Staining of Mitochondria with Janus green B.
7. Demonstration of diversity of cell types (Muscle, Neuron)
8. Study of mitosis (smear and squash method, root tip of onion).
9. Study of meiosis (pollen grain), Maize, Rat testis.
10. Determination of activity of sodium/potassium ATPase of plasma membrane.

Microbiology Lab

1. Instruments/equipments commonly used in Microbiology.
2. Washing and Sterilization of Lab wares.
3. Media preparation for growing (i) Bacteria (ii) Moulds (iii) Yeast.
4. Culturing of Microorganisms: (i) Slant preparation (ii) Suspension culture (iii) Streaking (iv) Plating.
5. Simple and Gram staining
6. Isolation of soil organisms, plate streaking method.
7. Counting of microorganisms using Haemocytometer in given sample (serial dilution)
8. Size measurement of microorganisms using stage and ocular micrometer.
9. Growth measurement by optical density/plating method.

MBT-162: BIOCHEMISTRY LAB

L T P **Credit: 1**

0 0 2

1. *Preparation* of buffers.
2. Standardization of pH meter, preparation of emulsions.
3. Spectroscopy: determination of absorption maxima of a given solution.
4. Quantitative estimation of carbohydrates
5. Distinguish reducing and non-reducing sugars
6. Quantitative and qualitative estimation of proteins
7. Separation of sugars, fatty acids and amino acids by paper chromatography
8. Extraction of lipids from seed
9. Thin layer chromatography
10. Gel electrophoresis

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

First year- Semester-II

MBT-211: MOLECULAR BIOLOGY

L	T	P	Credit-4
3	1	0	

OBJECTIVES:

This course will emphasize the molecular mechanisms of DNA replication, repair, protein synthesis etc. and also to demonstrate knowledge and understanding of the molecular machinery of living cells

OUTCOME:

At the end of this course students should be able to demonstrate a clear understanding of the facts and basic concepts of molecular biology which are covered in lectures, including:

1. To provide with the core principles of molecular biology.
2. To gain higher level thinking skills that is necessary for scientists.
3. This course should excite about basic science and its applications

CONTENTS:

Unit 1: **8 Hours**

DNA as a genetic material: Chemical structure and base composition, A, B, C, D and Z DNA, Griffith's and Hershey-Chase experiment, central dogma of Molecular biology, Genomic organization of prokaryotes & eukaryotes, Polytene and Lampbrush chromosomes. Chromatin: histone and non-histone proteins, chromatin remodeling. Transposons.

Unit 2: **8 Hours**

DNA replication, modes of replication, replisomes, DNA polymerases the DNA replicating enzymes, mechanism and regulation of DNA replication in prokaryotes and eukaryotes. Fidelity, extrachromosomal replicons, DNA repair and recombination.

Unit 3: **8 Hours**

Transcription, transcription unit, substrate for transcription, transcription apparatus, RNA polymerases, prokaryotic transcription, eukaryotic transcription, transcription factors, promoters and enhancers, various RNA species and their properties, processing of pre-mRNA to mature mRNA, RNA splicing, lariat Formation.

Unit 4: **8 Hours**

Translation: Prokaryotic & Eukaryotic and translation, aminoacylation of tRNA,the translational machinery, mechanisms of initiation elongation and termination, translation factors, regulation of translation. translation inhobitors, Post-translation modification of proteins, Protein localization and targeting.

Unit 5: **8 Hours**

The genetic code, properties of genetic code, wobble hypothesis, mechanism and regulation of gene expression in Prokaryotes and Eukaryotes, molecular chaperones, DNA-binding motifs, operon, negative and positive control, *lac* operon, *trp* operon, *ara* operon, attenuation, RNA interference.

Text/Reference Books:

1. Benjamin Lewin, Gene IX, 9th Edition, Jones and Barlett Publishers, 2007.
2. J.D. Watson, N.H. Hopkins, J.W Roberts, J. A. Seitz & A.M. Weiner; Molecular Biology of the Gene, 6
3. thEdition,Benjamin Cummings Publishing Company Inc, 2007.
4. Alberts et al; Molecular Biology of the Cell, 4th edition, Garland, 2002.

MBT-212: ENZYMOLOGY

L	T	P	Credit-4
3	1	0	

OBJECTIVES:

The objective of the course is to provide a deeper insight into the fundamentals of enzyme structure and function and kinetics of soluble and immobilized enzymes. Also it deals with current applications and future potential of enzymes. process. The student will be able to perform immobilization of enzymes.

OUTCOME:

1. At the end of this course students should be able to define enzyme structure, define differences between enzymes and normal catalytic substances, recognize the catalytic substances
2. Explain chemical structure of enzymes, recognize the enzymes chemical structure, explain cofactor and coenzymes chemical structure
3. Recognize chemical structures of biological cofactor and coenzymes and express Important coenzymes and the groups they transfer.

CONTENTS:

Unit 1: **8 Hours**

Classification and nomenclature of enzymes. Introduction to enzymes: Holoenzyme, apoenzyme, prosthetic group. Interaction between enzyme and substrate- lock and key model, induced fit model. Features of active site, activation energy, Enzyme denaturation and renaturation, enzyme specificity and types.

Unit 2: **8 Hours**

Kinetics of single substrate reactions; Derivation of Michaelis-Menten equation, turnover number; determination of Km and Vmax (LB plot, ED plot), Importance of Km & Vmax; Multi-Substrate reaction mechanisms. Enzyme inhibition: irreversible; reversible (competitive, uncompetitive and non competitive inhibition); Substrate and Product

inhibition, Ribozymes, Abzymes, allostearic enzyme, regulation of allostearic enzymes, concerted & sequential model;. Factors affecting the velocity of enzyme catalyzed reaction- enzyme concentration, temperature, pH, substrate concentration, inhibitors and activators.

Unit 3: **8 Hours**

Extraction of crude enzyme from plant, animal and microbial source; some case study. Purification of enzymes by the help of different methods (chromatographic techniques). Methods of characterization of enzymes; criteria of purity. Unit of enzyme activity - definition and importance.

Unit 4: **8 Hours**

Enzyme Immobilization: Adsorption, Matrix entrapment, Encapsulation, Cross linking, Covalent binding and their examples; Advantages and disadvantages of different immobilization techniques. Structure & stability of immobilized enzymes, kinetic properties of immobilized enzymes- partition effect, diffusion effect. Overview of applications of immobilized enzyme systems.

Unit 5: **8 Hours**

Enzyme Biosensors: elements of biosensors, three generations of biosensors, Types of biosensors: calorimetric, potentiometric, amperometric, optical and piezoelectric. Design of enzyme electrodes and their applications as biosensors in industry, health care and environment. Design of Immobilized Enzyme Reactors- Stirred tank reactors(STR), Continuous Flow Stirred Tank Reactors (CSTR), Packed- bed reactors (PBR), Fluidized-bed Reactors (FBR); Membrane reactors.

Text/Reference Books:

1. Fundamentals of enzymology by Nicolas C. price and Lewis stevens . Oxford University Press
2. Enzymes by Trevor palmer, East west Press
3. Enzyme Technology by Messing
4. Enzymes: Dixon and Webb. (IRL Press)
5. Enzyme technology by Chaplin and Bucke. Cambridge Univerity Press

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

MBT-213: GENETICS

L T P **Credit-4**

3 1 0

OBJECTIVE:

To describe the processes of gene regulation and predict how a gene will be expressed under specific circumstances.

OUTCOMES:

Genetics seeks to understand how genetic variation relates to human health and disease. When searching for an unknown gene that may be involved in a disease, researchers commonly use genetic linkage and genetic pedigree charts to find the location on the genome associated with the disease.

CONTENT:

Unit 1: **8 Hours**

Principles of Heredity and Variation: Mendel concept of genetics and his experiments, monohybrid crosses, dihybrid crosses, back cross and test cross. multiple alleles (blood group systems), maternal inheritance.

Unit 2: **8 Hours**

Gene Interaction: Concept of gene interaction, co-dominance and incomplete Dominance, Complementary factors, Supplementary factors, Inhibitory factors, Duplicate dominant factors, Lethal genes (dominant and recessive), Epistasis.

Unit 3: **8 Hours**

Genes and Chromosomes: General features of chromosomes. Chromosomal theory of inheritance, Sex determination. Sex-linked, Sex-limited and Sex-influenced inheritance.

Variation in chromosome number and structure, Inherited disorders - Allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal (Down syndrome and cri-du-chat syndrome).

Unit 4: **8 Hours**

Gene Linkage and Chromosome Mapping: Linkage and recombination of genes in a chromosome, Crossing over and genetic mapping, Gene mapping.

Unit 5: **8 Hours**

Population Genetics and Evolution:Allele frequencies and genotype frequencies, gene pool , genetic drift, random mating and Hardy-Weinberg principle. Inbreeding. Genetics and evolution.

Text/Reference Books:

1. S.R. Maloy, J.E. Cronan, D. Friefelder, Microbial Genetics, 2nd Edition, Jones and Bartlett Publishers, 1994.
2. N. Trun and J. Trempy, Fundamental Bacterial Genetics, Blackwell publishing, 2004.
3. Strachan T and Read A P, Human molecular genetics, 3rd Edition Wiley Bios, 2006.
4. Mange E J and Mange A. P., Human genetics, 2nd Edition, Sinauer Associates publications, 1999.
5. Hartl L D and Jones B, Analysis of genes and genomes, 3rd Edition, Jones and Bartlett Publishers, 1994

MBT-214 BIOSTATISTICS &BIOINFORMATICS

L	T	P	Credit-4
3	1	0	

OBJECTIVES:

Demonstrate an understanding of the central concepts of modern statistical theory and their probabilistic foundation and read and learn new statistical procedures independently

OUTCOME:

1. Recognize the importance of data collection and its role in determining scope of inference.
2. Demonstrate a solid understanding of interval estimation and hypothesis testing.
3. Choose and apply appropriate statistical methods for analyzing one or two variables.
4. Use technology to perform descriptive and inferential data analysis for one or two variables.
5. Interpret statistical results correctly, effectively, and in context.

CONTENTS:

Unit 1: **8 Hours**

Scope of biostatistics, Variables in biology, Collection, classification, tabulations and diagrammatic presentation of statistical data, Concepts of statistical population and sample, Measures of central tendencies and Dispersion, Simple measure of Skewness and kurtosis.

Unit 2: **8 Hours**

Probability – Definition, simple theorems of probability and simple application of probability.

Unit 3: **8 Hours**

Correlation, correlation coefficient, standard error of estimate and regression, linear regressions, least square method of fitting, Basic idea of significance, testing level of significance, random variations, Chi-square test, ANOVA.

BIOINFORMATICS

Unit 4: **8 Hours**

Introduction, classification and generation of computers, components of a computer system, input and output devices. Biological Data Bases: Primary, Secondary and Composite database, Nucleotide sequence databases, Protein sequence databases.

Unit 5: **8 Hours**

Genome sequencing projects, Structural sequence databases, Sequence analysis; Sequence alignment: Types and methods, Primer designing, Role of Bioinformatics in drug discovery and development.

Text/Reference Books:

1. Wayne W. Daniel, Biostatistics : A foundation for Analysis in the Health Sciences, 8th Edition, Wiley, 2004.
2. Prem S. Mann, Introductory Statistics, 6th Edition, Wiley, 2006.
3. John A. Rice, Mathematical Statistics and Data Analysis, 3rd Edition, John A. Rice, Duxbury Press, 2006.
4. Campbell and Heyer, Discovering Genomics, Proteomics, & Bioinformatics, 2nd Edition, Benjamin Cummings, 2002.
5. Cynthia Gibas and Per Jambeck, Developing Bioinformatics Computer Skill, 1st Edition, O'Reilly Publication, 2001.

MBT-261: MOLECULAR BIOLOGY LAB

L T P **Credit: 1**

0 0 2

1. Estimation of DNA content in the given sample by diphenylamine method. (Nitrogen cylinders, -20^{0}C fridge, grinders, cooling centrifuges etc.)
2. Estimation of RNA content by the Orcinol method.
3. Determination of Tm of DNA and RNA.
4. Isolation of Plasmid DNA.
5. Isolation of bacterial/fungal genomic DNA.
6. Isolation of plant DNA.

MBT-262: BIOSTATISTICS AND BIOINFORMATICS LAB

L T P **Credit: 1**

0 0 2

(Sec. A) Biostatistics Lab

1. Measure of central tendencies and dispersion
2. Measure of skewness and kurtosis
3. Probability
4. Binomial and poisson distribution.
5. Correlation and regression

(Sec. B) Bioinformatics Lab

1. Construction of database for specific class of proteins/enzymes, genes/ ORF/ EST/Promoter sequences
2. DNA motifs or protein motifs using oracle.
3. Access and use of different online protein and gene alignment softwares.
4. Gene finding related search for a given nucleotide sequence in order to predict the gene.
5. ORF prediction for different proteins out of some given nucleotide sequences.
6. Exon identification using available softwares for a given nucleotide sequences
7. Secondary structure prediction for amino acid sequences of a given protein.

Convener

Signature: .....

Name : Dr. Ajay Kumar

Date :

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Internal Members

Signature: 1..... 2.....

Name: Dr. Vivek Srivastava Er. Anjani Kumar Srivastava

Date:

External Members

Signature: 1..... 2.....

Name: Prof. Nand Lal Er. Vishal Kumar Srivastava

Date:

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Second year - Semester-III

MBT-311: IMMUNOLOGY

L	T	P	Credit-4
3	1	0	

OBJECTIVE:

To provide students with knowledge on how the immune system works building on their previous knowledge from biochemistry, genetics, cell biology and microbiology

OUTCOME:

1. The students will be able to identify the cellular and molecular basis of immune responsiveness.
2. The students will be able to describe the roles of the immune system in both maintaining health and contributing to disease.
3. The students will be able to describe immunological response and how it is triggered and regulated.
4. The students will be able to demonstrate a capacity for problem-solving about immune responsiveness.
5. The students will be able to transfer knowledge of immunology into clinical decision-making through case studies presented in class.

CONTENTS:

Unit 1: **8 Hours**

History & phylogeny of Immune system. Types of immunity. Cells & organs of the immune system. Structure and function of immunoglobulins. Nature of antigens, antigenicity and immunogenecity. Lymphocyte traffic.

Unit 2: **8 Hours**

BCR & TCR and generation of immunological diversity. Activation of B and T cell lymphocytes. Antigen antibody interactions, cross reactivity, precipitation reactions – their principles and applications serological techniques – ELISA, RIA and western blotting.

Unit 3: **8 Hours**

Immunological tolerance. Induction of tolerance; T-cell energy; immunologically privileged sites. MHC structure and function; MHC–polymorphism; disease susceptibility, MHC restriction. Antigen processing and presentation: generation of MHC class-I and class-II peptides and their association with antigenic peptides. Generation of immunological response and its genetic control. Transplantation immunology: Immunological basis of graft rejection; immunosuppressive therapy. Complement system: Consequences of complement activation and regulation.

Unit 4: **8 Hours**

Hypersensitivity reactions: Types of hypersensitive reactions: immunoprophylactic interventions. Autoimmunity–systemic and localized autoimmunity and probable mechanisms to develop autoimmunity. Immunodeficiency; primary, secondary immunodeficiency; SCID and AIDS. Tumor immunology–tumor antigens, immunological factors influencing the incidence of cancer, effecter mechanisms in cancer immunity.

Unit 5: **8 Hours**

Vaccines: Historical perspective; bacterial, viral vaccines and vaccines against cancer and birth control vaccines. Antibody engineering: monoclonal and polyclonal sera their role in clinical diagnosis; production of monoclonal antibodies; immunotoxins and their therapeutic uses; humanized and chimeric antibody.

Text/Reference Books:

1. Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne Immunology, 6th Edition, Freeman, 2002.
2. Brostoff J, Seaddin JK, Male D, Roitt IM., Clinical Immunology, 6th Edition, Gower Medical Publishing, 2002.
3. Janeway et al., Immunobiology, 4th Edition, Current Biology publications. 1999.
4. Paul, Fundamental of Immunology, 4th edition, Lippencott Raven, 1999.

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

MBT-312: PLANT BIOTECHNOLOGY

L	T	P	Credit-4
3	1	0	

OBJECTIVES:

The main objective of the study programme is to prepare motivated, able to think creatively plant biotechnology specialists familiar with plant biotechnological processes and equipped with the knowledge and skills allowing to understand the interaction of all elements of the technological process.

OUTCOME:

Students will be able to :

1. explain the basics of the physiological and molecular processes that occur during plant growth and development during environmental adaptation.
2. understand how biotechnology has been used to develop knowledge of complex processes that occur in the plants
3. use basic biotechnological techniques to explore molecular biology of plants
4. understand the processes involved in the planning, conduct and execution of plant biotechnology experiments
5. explain how biotechnology is used for plant improvement and discuss the ethical implications of that use

CONTENTS:

Unit 1: **8 Hours**

Introduction, history & importance of Plant tissue culture techniques. Principles of Plant Tissue Culture. Concepts of totipotency, competency, determinism, explants, inoculums. Requirements for a Plant Tissue Culture lab.

Unit 2: **8 Hours**

Nutrient media: Composition of commonly used nutrient culture media with respect to their contents like inorganic chemicals, organic constituents, vitamins, amino acids, Unidentified supplements, carbohydrate for energy source, phytohormones, complex substances, Activate

charcoal etc. An appraisal of different media, selection of media, Hormones: Auxins, cytokinins, Gibberellins, Abscisic Acid, ethylene. Surface sterilization. Basic procedure for Aseptic Tissue transfer. Sterilization of the media. Inoculation of culture.

Unit 3: **8 Hours**

Culture of plant materials- explants selection and technique of culturing the same. Growth conditions. Harvesting and Growth Measurements, organogenesis, Embryogenesis, Somaclonol variation, gametoclonal variation, Androgenesis and Gynogenesis, protoplast isolation, fusion and culture. Callus and cell culture, callus subculture and maintenance. Methods of subculturing and transfer of regenerated plants to the field, *in vitro* pollination and fertilization, Embryo culture and embryo rescue, endosperm culture.

Unit 4: **8 Hours**

Micropropagation: Proliferation of axillary buds, induction of adventitious buds and bulbs, callus, regeneration: somatic embryogenesis and organogenesis, continuous culture, immobilized cultures, estimation of growth and artificial seeds.

Unit 5: **8 Hours**

Cloning: Isolation of single cells, culturing of single cell- different methods, culture cell viability test. Cryopreservation and slow growth cultures, Freezing and storage, thawing, reculture. Applications of plant tissue culture in transgenic plants and production of secondary metabolites and industrial products.

Text Books & References

1. Bhojwani SS. Plant Tissue Culture: Theory and Practice . Elsevier, 1983.
2. Christou P & Klee H. Handbook of Plant Biotechnology. John Wiley & Sons. 2004.
3. Dixon RA. Plant Cell Culture. IRL Press, 2003.
4. George EF, Hall MA & De Klerk GJ. Plant Propagation by Tissue Culture. Agritech Publ. 2008.
5. Pena L. Transgenic Plants: Methods and Protocols. Humana Press, 2004.
6. Pierik RLM. In vitro Culture of Higher Plants. Kluwer, 1997.

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

MBT-313: ANIMAL CELL SCIENCE AND TECHNOLOGY

L	T	P	Credit-4
3	1	0	

OBJECTIVES:

Studying animal genomics and its varied applications.DNA forensics, molecular diagnostics, cloning, wildlife conservation, stem cell research and bio - processing technologies are other import areas of animal biotechnology.

OUTCOMES:

Upon successful completion of this subject, students should:

1. Be able to describe the structure of animal genes and genomes.
2. Be able to describe how genes are expressed and what regulatory mechanisms contribute to control of gene expression.
3. Be able to describe basic principles and techniques in genetic manipulation and genetic engineering.
4. Be able to describe gene transfer technologies for animals and animal cell lines.
5. Be able to describe techniques and problems both technical and ethical in animal cloning.

CONTENTS:

Unit 1: **8 Hours**

Introduction to cell culture, Basic techniques of mammalian cell culture: Primary and established cell line cultures, disaggregation of tissue and primary culture .Measurement of viability and cytotoxicity. Measurement of growth; culture media and role of serum. Designing of ATC lab, laboratory safety and biohazards. Biology and characterization of the cultured cells and maintenance of cell culture. Cell separation, Dispersion and disruption of tissues, Scaling-up of animal cell culture.

Unit 2: **8 Hours**

Cell cloning, micromanipulation, synchronization and transformation. Stem cell cultures, embryonic stem cells and their applications. Organ culture- Totipotency, Nuclear transfer experiments. Molecular events during fertilization and early development. Role of maternal gene contribution in early embryonic development.

Unit 3: **8 Hours**

Biology of Cancer: Oncogenes. Chemical carcinogenesis. Tumor suppressor genes from humans, structure, function and mechanism of action of pRB and p53 tumor suppressor proteins. Apoptosis- morphologic and biochemical features of apoptosis, role of apoptosis in regulating lymphocyte development.

Unit 4: **8 Hours**

Gene therapy and transgenic animals: Vector engineering, somatic and germ line manipulations, strategies of gene delivery, targeted gene replacement /augmentation, gene correction, gene editing and gene silencing. Genetic disorders; Construction of transgenic animals /gene knockouts. Ethical and biosafety considerations.

Unit 5: **8 Hours**

Molecular markers linked to human disorders/ diseases infections and disease resistance genes. Application of RFLP in forensics, disease prognosis, genetic counseling, pedigree varietal etc. Animal trafficking and poaching.

Text/Reference Books:

1. Watson, J.D., Gilman, M., Witowski J.and Zoller, M. Recombinant DNA, 2nd ed., Scientific American Books, 1983
2. Glick, B.R. and Pasternack, J.J. Molecular Biotechnology, 3rd ed., ASM Press, 2003
3. Davis J.M. Basic Cell Culture: A Practical Approach, IRL Press, 1998
4. Freshney R.I. Animal Cell Culture a practical approach, 1987

MBT-314: BIOPROCESS ENGINEERING & FERMENTATION TECHNOLOGY

L	T	P	Credit-4
3	1	0	

OBJECTIVES:

Bioprocess engineering is a highly interdisciplinary field of study which is strongly benefited. Students can actively experience the interconnection between biology, engineering, and physical sciences.

OUTCOME:

1. Students will be able to plan and execute experimental procedures. They understand how fermentation data are collected.
2. The students are able to document and analyse the data in a correct and scientific way.
3. Students will be able to analyse and interpret key elements of the fermentation data to operate the bioreactor accordingly.
4. Students understand the principles of fed-batch experiments in *E. coli*, and how catabolic repression affects protein and biomass yield.

CONTENTS:

Unit 1: **8 Hours**

History and development of fermentation industry, Air and media sterilization (physical, chemical, and radiation sterilization) Media for industrial fermentation (carbon, nitrogen, hydrogen, oxygen, sulphur, and other nutrients like precursors, buffers, inhibitors, inducers, surfactant etc.) Isolation, preservation and maintenance of microorganisms, Kinetics of microbial growth and death.

Unit 2: **8 Hours**

Types of fermentation process: batch, fed–batch and continuous bioreactors stability of microbial reactors, analysis of mixed microbial populations, Bioreactors (pulse, fluidized, photo bioreactors etc.). Measurement and control of bioprocess parameters.

Unit 3: **8 Hours**

Downstream processing: Introduction, removal of microbial cells and solid matter, foam separation, precipitation, filtration, centrifugation, cell disruption, liquid–liquid extraction, chromatography, membrane process, drying and crystallization.

Unit 4: **8 Hours**

Whole cell immobilization and its industrial application. Industrial production of chemicals: alcohol (ethanol), acids (citric, acetic and gluconic), solvents (glycerol, acetone, butanol), antibiotics (penicillin, streptomycin, tetracycline), amino acids (lysine, glutamic acid), single cell protein.

Unit 5: **8 Hours**

Introduction to food technology: Elementary idea of canning and packing. Sterilization and pasteurization of food products. Technology of typical food /food products (bread, butter, cheese, idli, curd, tea, coffee, jam, jelly, pickle, sauerkraut, and other processed food stuffs), Food preservation.

Text/Reference Books:

1. Jackson AT., Bioprocess Engineering in Biotechnology, Prentice Hall, Engelwood Cliffs, 1991.
2. Shuler ML and Kargi F., Bioprocess Engineering: Basic concepts, 2nd Edition, Prentice Hall, Engelwood Cliffs, 2002.
3. Stanbury RF and Whitaker A., Principles of Fermentation Technology, Pergamon press, Oxford, 1997.
4. Baily JE and Ollis DF., Biochemical Engineering fundamentals, 2nd Edition, McGraw-Hill Book Co.,New York, 1986.
5. Aiba S, Humphrey AE and Millis NF, Biochemical Engineering, 2nd Edition, University of Tokyo press, Tokyo, 1973.
6. Comprehensive Biotechnology: The Principles, Applications and Regulations of Biotechnology in Industry,Agriculture and Medicine, Vol 1, 2, 3 and 4. Young M.M., Reed Elsevier India Private Ltd, India, 2004.

MBT-361: PLANT TISSUE CULTURE LAB

L T P **Credit: 1**

0 0 2

1. Preparation of plant tissue culture media.
2. Surface sterilization.
3. Transfer of plants to soil.
4. Cell types of plants – TS / LS of various tissue explants and identification of Xylem, trachea, stomata, root hair etc.
5. Micropropagation of banana, citrus, Papaya, Sugarcane etc.
6. Synthetic seed preparation.
7. Anther and ovule culture.

MBT-362: IMMUNOLOGY LAB

L T P **Credit: 1**

0 0 2

1. To determine the blood group of given blood
2. To determine the Rh factor of given blood
3. To perform single radial immunodiffusion
4. To perform double immunodiffusion
5. To perform rocket immune electrophoresis
6. To perform ELISA
7. To prepare the blood smear and stain with Leishman stain
8. To identify the blood cells/ immune cell with the help of Leishman stain
9. To perform differential count (DLC) of given sample

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Second year- 4th Semester

MBT-411: Recombinant DNA Technology

L	T	P	Credit-4
3	1	0	

OBJECTIVES:

Genetic Engineering, in simple words, is a laboratory technique used by scientists to change the DNA of living organisms. This wonderful branch of engineering or science enables the human minds to interfere in and modify the processes of life, birth death and even offers escape from certain congenital diseases.

OUTCOMES:

Students will be able to:

1.Describe the importance of being able to locate the position of genes on chromosomes.

2.Describe the techniques involved in Genetic Engineering and show how this technology can be used to combine genetic material from two different species.

3.Explain how genes can be removed from chromosomes and inserted into different chromosomes.

4.Explain why bacterial cells are used in genetic engineering.

CONTENTS:

Unit 1: **8 Hours**

Introduction and need of genetic engineering, Type of Restriction enzymes, Restriction-modification, enzymes used in recombinant DNA technology- endonucleases, ligases and other enzymes useful in gene cloning, PCR technology for gene/DNA detection and amplification, cDNA, Use of *Agrobacterium* for genetic engineering in plants; Gene libraries; Use of marker genes. Cloning of foreign genes: DNA delivery methods - physical methods and biological methods, Genetic transformation of prokaryotes: Transferring DNA into *E. coli* –Chemical induction and Electroporation.

Unit 2: **8 Hours**

Gene cloning - concept and basic steps; application of bacteria and viruses in genetic engineering; Molecular biology of *E. coli* and bacteriophages in the context of their use in genetic engineering, Cloning vectors: Plasmid cloning vector pBR 322, Vectors for cloning large piece of DNA– Bacteriophage-λ and other phage vectors; Cosmids, Phagemids; YAC and BAC vectors, Model vectors for eukaryotes – Viruses.

Unit 3: **8 Hours**

Gene library: Construction cDNA library and genomic library, Screening of gene libraries screening by DNA hybridization, immunological assay and protein activity, Marker genes: Selectable markers and Scorable markers, non antibiotic markers.

Unit 4: **8 Hours**

Gene expression in prokaryotes: Tissue specific promoter, wound inducible promoters, Strong and regulatable promoters; increasing protein production; Fusion proteins; Translation expression vectors.

Unit 5: **8 Hours**

Origins of organismal cloning in developmental biology research on frogs; nuclear transfer procedures and the cloning of sheep (Dolly) & other mammals; applications in conservation; therapeutic vs. reproductive cloning; ethical issues and the prospects for human cloning; Two vector expression system; two-gene expression vector, Directed mutagenesis; transposon mutagenesis, Gene targeting, Site-specific recombination.

Text/Reference Books:

1. S.B. Primrose, R.M. Twyman and R.W.Old; Principles of Gene Manipulation. 6thEdition, S.B.University Press, 2001.
2. J. Sambrook and D.W. Russel; Molecular Cloning: A Laboratory Manual, Vols 1-3, CSHL, 2001.
3. Brown TA, Genomes, 3rd ed. Garland Science 2006
4. Technical Literature from Stratagene, Promega, Novagen, New England Biolab etc

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

MBT-412: MICROBIAL BIOTECHNOLOGY

L T P **Credit: 4**

3 1 0

OBJECTIVES:

Our curriculum is designed to educate our majors in a variety of important microbiological disciplines, as well as to promote and develop skills and competencies that have enduring value beyond the classroom.

OUTCOME:

Students will be able to:

1.Define/explain within multiple microbiology disciplines the core theories and practices;
2.Describe/explain the processes used by microorganisms for their replication, survival, and interaction with their environment, hosts, and host populations;
3.Demonstrate practical skills in the use of tools, technologies and methods common to microbiology, and apply the scientific method and hypothesis testing in the design and execution of experiments.

CONTENTS:

Unit 1: **8 Hours**

Microbial biotechnology, scope and techniques, Bioprospecting of microbial diversity, Isolation and preservation of industrially important microorganisms. Genomics.

Unit 2: **8 Hours**

Production of recombinant and synthetic vaccines. Microbial polysaccharides and polyesters Microbes as biocontrol agents microbial insecticides (Baculoviruses,entomopathogenic fungi, Bacillus thurinigiensis Bacillus sphaericus Bacillus popilae, Microbe derived Inhibitors)

Unit 3: **8 Hours**

Microbial biomass production, utilization of plant biomass by microorganisms (lignocellulose biodegradation), ethanol production, amino acids, organic acids, antibiotics .Biotransformation of steroid and non steroid compounds.

Unit 4: **8 Hours**

Biology of nitrogen fixation, preparation of different types of inoculants (nitrogen fixers phosphate solubilizers, plant growth promoting rhizobacteria, PGPR, composting).

Unit 5: **8 Hours**

Introduction to the use of microbes in environmental applications, Bioremediation, bioaugemntation, Bioemulsifiers, biosurfactants, Microbial Enhanced Oil Recovery (MEOR), Leaching of ores. Microbial fuels (Methane, Hydrogen).

Text/Reference Books:

1. Alexander n. Glazer Hiroshi Nikaido W.H. Microbial Biotechnology, Freeman and Company, 1995
2. Kun LY. Microbial Biotechnology. World Scientific, 2006.
3. Crueger and A Crueger, (English Ed., TDW Brock); Biotechnology: A textbook of Industrial Microbiology, Sinaeur Associates, 1990.
4. G Reed, Prescott and Dunn's, Industrial Microbiology, 4th Edition, CBS Publishers, 1987.
5. M.T. Madigan and J.M. Martinko, Biology of Microorganisms, 11th Edition, Pearson Prentice Hall, USA, 2006.

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

MBT-413: MEDICAL BIOTECHNOLOGY

L T P **Credit-4**

3 1 0

OBJECTIVE:

The students will be able to identify the cellular and molecular basis of immune responsiveness the roles of the immune system in both maintaining health and contributing to disease.

OUTCOMES:

Medical Biotechnology is the study of the immune system in both healthy and diseased states. It includes the study of how the body fights infections from bacteria and viruses, and the development of medical interventions to treat and prevent diseases.

CONTENTS:

Unit 1: **8 Hours**

Basic requirements for animal cell culture, Cell culture media and reagents. Animal cell, tissue and organ cultures, Primary culture, Secondary culture Somatic cell cloning and hybridization, Transfection and transformation of cells. Application of animal cell culture for in vitro testing of drugs, testing of toxicity of environmental pollutants in cell culture.

Unit 2: **8 Hours**

Classification and sources of Stem cells Overview of embryonic and adult stem cells. Therapeutic applications of stem cells in neurodegenerative diseases, Cardiomyopathy and diabetes. Ethical considerations in human stem cell research.

Unit 3: **8 Hours**

Haematopoiesis and Cells of the Immune system Structure and functions of Immunoglobulins Antigen – Antibody based diagnostic assay Monoclonal antibody and its applications.

Unit 4: **8 Hours**

Complement system Autoimmune diseases AIDS and other immunodeficiency diseases Infections, Immunity and Vaccines.

Unit 5: **8 Hours**

Endocrine disorders Vitamins and vitamin deficiency diseases Congenital disorders and Chromosomal abnormalities Cell death pathways, Cancer Biology.

Text/Reference Books:

1. Firdos Alam Khan,Biotechnology in Medical Sciences, CRC Press, 2014
2. Judit Pongracz Mary Keen, Medical Biotechnology, Elsevier, 2008
3. Watson, J.D., Gilman, M., Witowski J.and Zoller, M. Recombinant DNA, 2nd ed., Scientific American Books, 1983
4. Glick, B.R. and Pasternack, J.J. Molecular Biotechnology, 3rd ed., ASM Press, 2003
5. Davis J.M. Basic Cell Culture: A Practical Approach, IRL Press, 1998
6. Freshney R.I. Animal Cell Culture a practical approach, 1987

MBT-414: ENVIRONMENTAL BIOTECHNOLOGY

L T P **Credit-4**

3 1 0

OBJECTIVE:

One of the main objectives of environmental biotechnology is the conservation of resources via the recycling of waste materials Reclaiming organically polluted water, application of microbes to degrade recalcitrant compounds, use of animal waste as fertilizer, recycling of microbial protein as an animal feed and removal of heavy metals found in sewage sledges, are examples of this type of technology.

OUTCOME:

By the end of the course, the student should be able to

1. Outline the principles of methods for quantification of organic carbon in wastewater and calculate the theoretical oxygen demand (ThOD) for simple organic compounds.
2. Explain the microbial processes and growth requirements undelaying the activated sludge process, nitrification, denitrification, enhanced phosphorus removal, and anaerobic digestion
3. Describe the most commonly applied disinfection methods, and the steps typically involved in drinking water treatment process
4. Evaluate the potential for biodegradation of organic pollutants, taking microbial and physical/chemical environments, as well as the chemical structure of the compound itself, into consideration

CONTENTS:

Unit 1: **8 Hours**

Introduction of biotechnology in environment: basic concept and Environmental pollution: types of pollution, methods for the measurement of pollution; methodology of environmental management the problem solving approach, its limitations.

Unit 2: **8 Hours**

Air pollution and its control through biotechnology. Water pollution and its control: water as a scarce natural resources, need for water management, measurement of water pollution, sources of water pollution, waste water treatment – physical, chemical and biological treatment processes.

Unit 3: **8 Hours**

Microbiology of waste water treatments, aerobic process: activated sludge, oxidation ditches, trickling filters, towers, rotating discs, rotating drums, oxidation ponds. Anaerobic processes: anaerobic digestion, anaerobic filters, upflow anaerobic sludge blanket reactors. Treatment schemes for waste waters of dairy, distillery, tannery, sugar, antibiotic Industries. Solid wastes: sources and management (Composting, vermiculture and methane production).

Unit 4: **8 Hours**

Microbiology of degradation of xenobiotics in environment – ecological considerations, decay behaviour & xenobiotics degradative plasmids; hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, pesticides. Biopesticides in integrated pest management. Bioremediation of contaminated soils and wasteland.

Unit 5: **8 Hours**

Global environmental problems: environmental issues related to BT cotton, BT brinjal, and GM foods and crops in Indian scenario, ozone depletion, UV-B, green house effect and acid rain, their impact and biotechnological approaches for management.

Text/Reference Books:

1. Chakrabarty K.D., Omen G.S.Biotechnology And Biodegradation, Advances In
2. Applied Biotechnology Series , Vol.1, Gulf Publications Co., London, 1989.
3. Waste water Engineering Treatment, Disposal and Reuse. Metcalf & Eddy (1991) Mc Graw Hill.
4. Environmental Biotechnology, Forster, C. Fand Waste, D.A. J. (1987) Ellis Horwood Halsted Press.
5. Environmental Biotechnology by Alan Scragg (1999); Longman.

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

MBT-415: GENOMICS & PROTEOMICS

L T P **Credit: 4**

3 1 0

OBJECTIVE:

Genetic engineer is gene manipulation / gene cloning/recombinant DNA technology. The primary objective of this practice is to have as many identical copies of a gene.

OUTCOMES:

Genetic engineering is an important tool for natural scientists, with the creation of transgenic organisms one of the most important tools for analysis of gene function. ... Loss of function experiments, such as in a gene knockout experiment, in which an organism is engineered to lack the activity of one or more genes.

CONTENTS:

Unit 1: **8 Hours**

Introduction Structural organization of genome in Prokaryotes and Eukaryotes; Organelle DNA-mitochondrial, chloroplast; DNA sequencing-principles and translation to large scale projects; Recognition of coding and non-coding sequences and gene annotation; Tools for genome analysis-RFLP, DNA fingerprinting, RAPD, PCR, Linkage and Pedigree analysis-physical and genetic mapping.

Unit 2: **8 Hours**

Genome sequencing projects Microbes, plants and animals; Accessing and retrieving genome project information from web; Comparative genomics, Identification and classification using molecular markers-16S rRNA typing/sequencing, ESTs and SNPs.

Unit 3: **8 Hours**

Proteomics Protein analysis (includes measurement of concentration, amino-acid composition, N-terminal sequencing); 2-D electrophoresis of proteins; Microscale solution isoelectricfocusing; Peptide fingerprinting; LC/MS-MS for identification of proteins and modified proteins; MALDI-TOF; SAGE and Differential display proteomics, Protein-protein interactions, Yeast two hybrid system.

Unit 4: **8 Hours**

Pharmacogenetics High throughput screening in genome for drug discovery-identification of gene targets, Pharmacogenetics and drug development.

Unit 5: **8 Hours**

Functional genomics and proteomics Analysis of microarray data; Protein and peptide microarray-based technology; PCR-directed protein in situ arrays; Structural proteomics.

Texts/References:

1.Voet D, Voet JG & Pratt CW, Fundamentals of Biochemistry, 2Nd Edition. Wiley 2006
2.Brown TA, Genomes, 3 rdEdition. Garland Science 2006
3. Campbell AM & Heyer LJ, Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings 2007
4. Primrose S & Twyman R, Principles of Gene Manipulation and Genomics, 7th Edition, Blackwell, 2006.
5.Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition, ASM Press, 1998.

MBT-461: PROJECT WORK AND PRESENTATION

A student has to make a latest technology based project in their respective stream. It may be hardware or software based.

Convener

Signature: .....
Name : Dr. Ajay Kumar
Date :

Internal Members

Signature: 1..... 2.....
Name: Dr. Vivek Srivastava Er. Anjani Kumar Srivastava
Date:

External Members

Signature: 1..... 2.....
Name: Prof. Nand Lal Er. Vishal Kumar Srivastava
Date: