Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Ref: RU/FS/BT/UG/2014/001 **Dated: 24.05.2014**

Minutes of Meeting

BOARD OF STUDIES

Department of Biotechnology

A meeting of Boards of Studies of B.Sc. (Hons.) in Department of Biotechnology held on 24.05 2014 at 10:30 AM. Director Office. The following members were present:

1.	Mr. Ajit P. Singh Yadav	Chairperson
2.	Mr. Anjani kumar Srivastava	Member
3.	Mr. Vachaspati Rao	Member
4.	Mrs. Rati Bajpai	Member (Invited)
5.	Mrs. Tanima Hajra	Member (Invited)
6.	Prof. (Dr.). R. K. Mishra	External Member
7.	Dr. G. Sunil Babu	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 24.05 2014 at 10:30 AM

2. Review of the existing programs and their curricula

S. No.	Item No.	Existing	Recommendation /Action Taken
1	To consider and approved the evaluation scheme for B.Sc.(Hons) Biotechnology students admitted in the session 2014-15.		The BOS considered the curricula & courses and discussed the credit of each course should be added in detailed syllabus of every subject. The BOS committee has given following suggestions: 1. The course name Biophysical tools and

			techniques (semester III) should be swapped by the course Genetics (Semester II). 2. The course name Animal Biotechnology (semester VI) should be swapped by the course Cell and tissue culture techniques (Semester IV). 3. The course name Immunology (semester VI) should be swapped by the course Industrial biotechnology (Semester IV). The BOS committee recommended curricula & courses after the above suggested points with their course code.

3. Question Paper Format.

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 : Ajit P. Singh Yadav

Date:

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Internal Members

Signature 1.....

Name : Mr. Anjani kumar Srivastava

Date:

Signature 2.....

Name : Mr. Vachaspati Rao

Date:

Signature 3.....

Name : Mrs. Rati Bajpai

Date:

Signature 4 .....

Name : Ms. Tanima Hajra

Date:

External Members

Signature 1.....

Name : Prof. (Dr.) R. K. Mishra

Date:

Signature 2.....

Name : Dr. G. Sunil Babu

Date:

Encl.: Recommended Curricula attached for consideration and approval.

CC:

1. Dean
2. Registrar Office

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

B.Sc. BIOTECHNOLOGY

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO 1: To impart knowledge and skills in techniques of basic sciences related to biological and chemical sciences.

PEO 2: To develop human resource and entrepreneurs in biotechnology with the ability toindependently start their own ventures or small biotech units in the field of biotechnology.

PEO 3: Scale up of biochemical process after designing, optimization and analysis for developing products required for society.

PEO 5: Tabulation and interpretation of Biological data using computer software.

PEO 6: To train the students for industrial need and to pursue further education.

PEO 7: Apply the knowledge of molecular biology, genetics, microbiology, Biochemistry and bioinformatics to derive a solution of complex biotechnological problems.

PROGRAMME OUTCOMES (PO)

PO 1: Identify, analyse and understand the problems related to life sciences and find valid conclusions with basic knowledge acquired in Biotechnology.

PO 2: Effectively communicate the biotechnological information in writing and oral presentation.

PO 3: Understand modern microbiology - practices and approaches with an emphasis in technology application in pharmaceutical, medical, industrial, environmental and agricultural areas.

PO 4: Design and develop solution to major environmental problems by applying modern biotechnological tools while keeping in mind the safety factors for environment and society.

PO 6: Gain experience in Experimental or Case Study design, Scientific Data Analysis, Writing and Communication, Ethical Practices and Effective Collaboration.

PO 7: Impart skills in international teamwork and research collaboration.

PO 8: Build Knowledge of Current industrial practice including Biotechnology Innovations and Molecular Biological Techniques.

PO 9: Become familiar with public policy, bio-safety, and intellectual property rights issues related to microbiology applications nationally and globally

PO 10: Gain experience with standard molecular tools and approaches utilized: manipulate genes, gene products and organisms.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1: Empower the students to acquire technological knowhow by connecting disciplinary and interdisciplinary aspects of biotechnology.

PSO 2: Students are able to learn the modern molecular biological techniques viz, chromatography, SDS-PAGE, Agarose Gel Electrophoresis, fermentation, downstream processing and PCR which are very much required for the large-scale production of biotechnology derived products.

PSO 3: Students acquire knowledge required for the production of Antibiotics, Vitamins, Hormones, enzymes, proteins and manufacturing industrially important secondary metabolites through fermentation process.

PSO 4: Recognize the importance of IPR, TRIPS, GATT, PATENT, Bioethics, Entrepreneurship, communication and management skills so as to prepare the next generation of Indian Industrialist.

PSO 5: Graduates will be able to justify health safety and legal issues and understand the biotechnological principles behind.

PSO 6: Students will be able to demonstrate their ability to apply biotechnological research strategies to solve the global environmental problems like climate change, Acid rain, ozone depletion, industrial waste treatment and bioremediation.

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

RAMA UNIVERSITY

Ordinances for

Bachelor of Science (Hons.) Biotechnology

RAMA UNIVERSITY, KANPUR

Ordinances for

Bachelor of Science (Hons.) 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 B.Sc. (Hons.) Biotechnology First year in Ist 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 B.Sc. (Hons.)Biotechnology First Year:

Candidates who have passed Intermediate of U.P. Board or (10+2) standard from other board with Physics and Chemistry as compulsory subject along with one of the following subjects:- Bio-Technology /Biology are eligible for admission to first year of 3 year B.Sc. (Hons.) 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 B.Sc. (Hons) Biotechnology Course shall be 3 years, each year comprising of two 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 3 year curriculum has been divided into 6 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 6 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 upto 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 Six 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:

9.1A 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.

9.2A 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:

11.1The 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 15 marks, in maximum five subjects but not more than three 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 up to that time.

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

18.1 The marks Mini Project Report shall be awarded on the following basis

18.2

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

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

Criteria	Internal	External	Total
Project Report	50	150	200
Viva Voce	50	100	150
Total	**100**	**250**	**350**

18.3 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 – In-charge.

(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

[Effective from the Session 2014-15]

B. Sc. (Hons.) Biotechnology

1st, 2nd & 3rd Year

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Course Detail & Evaluation Scheme

Effective from the Session 2014-15

B.Sc. (Hons.) Biotechnology

FIRST YEAR- 1ST SEMESTER

S.N.	Subject Code	Subject Name	Period			Evaluation Scheme			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory subjects										
1	BBS-101	Chemistry-I	3	1	0	20	20	60	100	4
2	BBS-102	Fundamentals of Physics	3	1	0	20	20	60	100	4
3	BBS-103	Professional Communication	3	1	0	20	20	60	100	4
4	BBS-104	Computer Fundamental & Office Automation	3	1	0	20	20	60	100	4
5	BBS-105	Elementary Mathematics	3	1	0	20	20	60	100	4
Practicals / Project										
6	BBS-151	Chemistry Lab	0	0	2	30	20	50	100	2
7	BBS-152	Office Automation Lab	0	0	2	30	20	50	100	2
		Total	**15**	**5**	**4**	**160**	**140**	**400**	**700**	**24**

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**

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

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 : Ajit P. Singh Yadav

Date:

Internal Members

Signature 1.....

Name : Mr. Anjani kumar Srivastava

Date:

Signature 2.....

Name : Mr. Vachaspati Rao

Date:

Signature 3.....

Name : Mrs. Rati Bajpai

Date:

Signature 4 .....

Name : Ms. Tanima Hajra

Date:

External Members

Signature 1.....

Name : Prof. (Dr.). R. K. Mishra

Date:

Signature 2.....

Name : Dr. G. Sunil Babu

Date:

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Course Detail & Evaluation Scheme

Effective from the Session 2014-15

B.Sc. (Hons.) Biotechnology

FIRST YEAR- 2ND SEMESTER

S.N.	Subject Code	Subject Name	Period			Evaluation Scheme			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory subjects										
1	BBS-201	Chemistry-II	3	1	0	20	20	60	100	4
2	BBS-202	Biochemistry	3	1	0	20	20	60	100	4
3	BBS-203	Cell Biology	3	1	0	20	20	60	100	4
4	BBS-204	Microbiology	3	1	0	20	20	60	100	4
5	BBS-205	Biophysical tools & Techniques	3	1	0	20	20	60	100	4
Practicals / Project										
6	BBS-251	Cell Biology Lab	0	0	2	30	20	50	100	2
7	BBS-252	Microbiology Lab	0	0	2	30	20	50	100	2
		Total	**15**	**5**	**4**	**160**	**140**	**400**	**700**	**24**

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

3. Attendance: 5 Marks
4. 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 : Ajit P. Singh Yadav

Date:

Internal Members

Signature 1……

Name : Mr. Anjani kumar Srivastava

Date:

Signature 2……

Name : Mr. Vachaspati Rao

Date:

Signature 3……

Name : Mrs. Rati Bajpai

Date:

Signature 4 ……

Name : Ms. Tanima Hajra

Date:

External Members

Signature 1……

Name : Prof. (Dr.). R. K. Mishra

Date:

Signature 2……

Name : Dr. G. Sunil Babu

Date:

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Course Detail & Evaluation Scheme

Effective from the Session 2014-15

B.Sc. (Hons.) Biotechnology

SECOND YEAR- 3RD SEMESTER

S.N.	Subject Code	Subject Name	Period			Evaluation Scheme			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory subjects										
1	BBS-301	Enzymology	3	1	0	20	20	60	100	4
2	BBS-302	Plant Physiology	3	1	0	20	20	60	100	4
3	BBS-303	Animal Physiology	3	1	0	20	20	60	100	4
4	BBS-304	Genetics	3	1	0	20	20	60	100	4
5	BBS-305	Plant Biotechnology	3	1	0	20	20	60	100	4
Practicals / Project										
6	BBS-351	Enzymology Lab	0	0	2	30	20	50	100	2
7	BBS-352	Plant Biotechnology Lab	0	0	2	30	20	50	100	2
		Total	**15**	**5**	**4**	**160**	**140**	**400**	**700**	**24**

BHU-001 *Human Values & Professional Ethics (Audit Course) – Student can clear from 2nd year to Third year.*

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

5. Attendance: 5 Marks
6. 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 : Ajit P. Singh Yadav

Date:

Internal Members

Signature 1.....

Name : Mr. Anjani kumar Srivastava

Date:

Signature 2.....

Name : Mr. Vachaspati Rao

Date:

Signature 3.....

Name : Mrs. Rati Bajpai

Date:

Signature 4 .....

Name : Ms. Tanima Hajra

Date:

External Members

Signature 1.....

Name : Prof. (Dr.). R. K. Mishra

Date:

Signature 2.....

Name : Dr. G. Sunil Babu

Date:

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Course Detail & Evaluation Scheme

Effective from the Session 2014-15

B.Sc. (Hons.) Biotechnology

SECOND YEAR- 4TH SEMESTER

S.N.	Subject Code	Subject Name	Period			Evaluation Scheme			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory subjects										
1	BBS-401	Molecular Biology	3	1	0	20	20	60	100	4
2	BBS-402	Animal Biotechnology	3	1	0	20	20	60	100	4
3	BBS-403	Biostatistics	3	1	0	20	20	60	100	4
4	BBS-404	Bioinformatics	3	1	0	20	20	60	100	4
5	BBS-405	Ethics, Patenting and Bio-Entrepreneurship	3	1	0	20	20	60	100	4
Practicals / Project										
6	BBS-451	Molecular Biology Lab.	0	0	2	30	20	50	100	2
7	BBS-453	Bioinformatics Lab	0	0	2	30	20	50	100	2
Total			**15**	**5**	**4**	**160**	**140**	**400**	**700**	**24**

BHU-001 *Human Values & Professional Ethics (Audit Course) – Student can clear from 2nd year to Third year.*

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

7. Attendance: 5 Marks
8. 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 : Ajit P. Singh Yadav

Date:

Internal Members

Signature 1……

Name : Mr. Anjani kumar Srivastava

Date:

Signature 2……

Name : Mr. Vachaspati Rao

Date:

Signature 3……

Name : Mrs. Rati Bajpai

Date:

Signature 4 ……

Name : Ms. Tanima Hajra

Date:

External Members

Signature 1……

Name : Prof. (Dr.). R. K. Mishra

Date:

Signature 2……

Name : Dr. G. Sunil Babu

Date:

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Course Detail & Evaluation Scheme

Effective from the Session 2014-15

B.Sc. (Hons.) Biotechnology

THIRD YEAR- 5TH SEMESTER

S.N.	Subject Code	Subject Name	Period			Evaluation Scheme			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory subjects										
1	BBS-501	Genetic Engineering	3	1	0	20	20	60	100	4
2	BBS-502	Environmental Science	3	1	0	20	20	60	100	4
3	BBS-503	Immunology	3	1	0	20	20	60	100	4
Practicals / Project										
4	BBS-551	Immunology Lab	0	0	2	30	20	50	100	2
5	BBS-552	Mini Project Work and Presentation	0	0	10	100	-	200	300	10
		Total	**9**	**3**	**12**	**190**	**80**	**430**	**700**	**24**

BHU-001 *Human Values & Professional Ethics (Audit Course) – Student can clear from 2nd year to Third year.*

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

9. Attendance: 5 Marks
10. 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: 100 Marks

Major Project/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 or 200 Marks

Convener

Signature.....

Name : Ajit P. Singh Yadav

Date:

Internal Members

Signature 1.....

Name : Mr. Anjani kumar Srivastava

Date:

Signature 2.....

Name : Mr. Vachaspati Rao

Date:

Signature 3.....

Name : Mrs. Rati Bajpai

Date:

Signature 4 .....

Name : Ms. Tanima Hajra

Date:

External Members

Signature 1.....

Name : Prof. (Dr.). R. K. Mishra

Date:

Signature 2.....

Name : Dr. G. Sunil Babu

Date:

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Course Detail & Evaluation Scheme

Effective from the Session 2014-15

B.Sc. (Hons.) Biotechnology

THIRD YEAR- 6TH SEMESTER

S.N.	Subject Code	Subject Name	Period			EVALUATION SCHEME			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory subjects										
1	BBS-601	Industrial Biotechnology	3	1	0	20	20	60	100	4
2	BBS-602	Cell and Tissue Culture Techniques	3	1	0	20	20	60	100	4
Practicals / Project										
3	BBS-651	Major Project Work and Presentation	0	0	12	100	-	250	350	12
4	BBS-652	Seminar	0	0	2	50	-	100	150	4
Total			**6**	**2**	**14**	**190**	**40**	**470**	**700**	**24**

BHU-001 *Human Values & Professional Ethics (Audit Course) – Student can clear from 2nd year to Third year.*

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

11. Attendance: 5 Marks
12. 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: 100 or 50 Marks

Major Project/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: 250 or 100Marks

Convener

Signature.....

Name : Ajit P. Singh Yadav

Date:

Internal Members

Signature 1.....

Name : Mr. Anjani kumar Srivastava

Date:

Signature 2.....

Name : Mr. Vachaspati Rao

Date:

Signature 3.....

Name : Mrs. Rati Bajpai

Date:

Signature 4 .....

Name : Ms. Tanima Hajra

Date:

External Members

Signature 1.....

Name : Prof. (Dr.). R. K. Mishra

Date:

Signature 2.....

Name : Dr. G. Sunil Babu

Date:

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

First year-1st Semester

BBS-101 Chemistry-I

L(3)/T(1)/P(0) **Credit-4**

Objectives:

- To understand basic facts and concepts in Chemistry while retaining the exciting aspects of Chemistry so as to develop interest in the study of chemistry as a discipline.

Outcomes: At the end of the course, the student will be able to:

- Understand the concepts of structure and bonding in organic molecules
- Acquire basic knowledge of organic chemistry and apply the concepts of organic chemistry for synthesis
- Understand the basic principles of stereochemistry.
- Understand the nomenclature, Classification, isomerism, synthesis and properties of alkanes and cycloalkanes
- Understand the nomenclature, Classification, isomerism, synthesis and properties of alcohols

Content:

Unit I:

Structure and Bonding: Hybridizations, Bond lengths and bond angles, bond energy, Electron displacement in organic chemistry (resonance, hyperconjugation, inductive and field effects),types of hydrogen bonding.[8]

Unit II:

Types of Reagents and Reactions: Electrophiles and nucleophiles. Reactive intermediates-carbocations, carbanions, free radicals and carbenes. Types of organic reactions special reference of nucleophilic substitution reaction. [8]

Unit III:

Stereochemistry: Conformations w.r.t. ethane, butane and cyclohexane; Concept of chirality; Enantiomerism, Diastereomerism , R-S &E-Z nomenclature. [8]

Unit IV:

Alkanes: IUPAC nomenclature, classification, isomerism in alkanes, sources, and methods of preparation (with special reference to Wurtz, Kolbe,s, Corey-House reactions and decaroxylation). Physical and chemical properties of alkanes. Mechanism of free radical halogenation of alkanes.

Cycloalkanes : Nomenclature, methods of preparations, chemical reactions. Bayer's strain theory and its limitations. ring strain in cyclopropane and cyclobutanes. Theory of stainless rings. [8]

Unit V:

Alcohols: Preparation of primary alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters, Reactions with sodium, HX (Lucas test), etherification, oxidation (with alk. $KMnO_4$, acidic dichromate, conc. HNO_3). Oppeneauer oxidation; Diols: oxidation of diols. Pinacol-Pinacolone rearrangement. [8]

Recommended Text/Reference Books

1. R. T. Morrison & R. N. Boyd: Organic Chemistry, Prentice Hall.
2. Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand
3. Textbook of Practical Organic Chemistry, A.I. Vogel, Prentice Hall, 5Th edition.

BBS-102 Fundamentals of Physics

L(3)/T(1)/P(0) **Credit-4**

Objectives :

- 1. The students will introduce about the elasticity, Surface tension and knowledge about the Constraint
- 2. The course will give knowledge about the general parameter like Viscosity, Poiseulles equation.
- 3. The course provides the students about the knowledge of laser applications, Fiber Optics.
- 4. The course provides the students about the knowledge of thermodynamics and semiconductor.

Outcomes :

- Get the knowledge about elasticity helps the students in their daily life.
- The Viscosity, Poiseulles equation parameter give the knowledge about how the liquid flow.
- The information will teach the students about the concept of flow of liquid.

Content:

Unit I:

Elasticity**:** Stress and strain in solids; Hook's law; Stress-strain curves; Limit of elasticity; Relevance of elasticity to life sciences; Surface tension: Surface tension and surface energy: Definition, concept and derivation; Capillary action; Angle of contact; Temperature dependence of surface tension. [8]

Unit II:

Fluid Statics & Fluid Dynamics :Stream line and turbulent flow of liquids,Viscosity,coefficient of viscosity, stokes law, Terminal velocity The variation of pressure in a fluid at rest, Flow of liquids through capillaries, Poiseulles equation, Derivations and physical significance. [8]

Unit III:

Modern Optics

Laser: Spontaneous and stimulated emission of radiation, population inversion, concept of 3 and 4 level Laser, construction and working of Ruby, He-Ne lasers and laser applications.

Fiber Optics: Fundamental ideas about optical fiber, Propagation mechanism, Acceptance angle and cone, Numerical aperture, Single and Multi Mode Fibers . [8]

Unit IV:

Thermodynamics: First law of thermodynamics- Mathematical form, applications, Indicator diagram and concept of cyclic process; Second law of thermodynamics- Concept of entropy with examples; Carnot cycle and its efficiency, Degrees of freedom. [8]

Unit V:

Semi conductors: conductor, insulator, semiconductor, intrinsic and extrinsic semiconductors, p-n junction diode, half wave rectifier and full wave rectifier, p-n-p transistor and n-p-n Transistor, transistor as an amplifier, Light Emitting diode. [8]

Recommended Text/Reference Books

1. Physics - David Hallday and Robert Resnick(Vol. I and II) (Willey Eastern Ltd.)

2 Fundamentals of mechanics - S.K. Saxena (Himalaya Publication)

3 Perspectives of modern physics - Arthur Beiser (Mc Graw Hill)

4 Heat and thermodynamics - Zemansky (Mc Graw Hill)

5. Principle of electronics –V.K.Mehta

BBS-103 Professional Communication

L(3)/T(1)/P(0) **Credit-4**

Objectives:

- Educate students to be problem solvers who are especially strong in oral and written communication.
- Encourage students' analytical and creative skills in order that they will be prepared to address a wide variety of challenges in their professional lives.
- Prepare students for lifelong productive careers which may include graduate studies, communication professions or corporate leadership.

Outcomes:

- Students should become adept in their use of the spoken word in interpersonal communication, small group interactions and public speaking.
- Students should have conducted original research involving literature review, research design and implementation including appropriate application of data analysis tools.
- Students should demonstrate the ability to apply rhetorical principles in a variety of creative, cinematic, organizational, professional and journalistic venues.
- Students should have determined the communication sub-field of greatest personal interest and have constructed a curriculum allowing the development of critical awareness and application skills specifically related to that sub-field.

Content:

Unit- I: FUNDAMENTALS OF COMMUNCATION

Technical Communication: Features: Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of communication: Downward, Upward, Lateral or Horizontal (peer group); Importance of technical communication; Barriers to Communication.

Unit-II: WRITING CORRECT ENGLISH

The Sentence: Meaning and definition, Kinds of Sentences; Tenses; Present, Past and Future; Concord: Meaning; Concord of Numbers and Persons; Active and Passive Voice; Direct and indirect Narration; Articles.

Unit-III: CONSTITUENTS OF TECHNICAL WRITTEN COMMUNICATION

Words and Phrases: Word formation, Synonyms and Antonyms; Homophones; Select vocabulary of about 500- 1000 new words; Correct Usage; All Parts of Speech; Modals; Concord; Articles; Infinitives; Requisites of Sentence Construction: Paragraph Development: Techniques and Methods- Inductive, Deductive, Spatial, Linear, Chronological etc.; The Art of Condensation- various steps.

Unit-IV: BUSINESS COMMUNICATION

Principles. Sales & Credit letters; Claim and Adjustment Letters; Job application and Resumes. Reports: Types; Significance; Structure, Style $ Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal; Significance. Negotiation and Business Presentation Skills.

Unit-V: PRESENTATION STRATEGIES AND SPEECH MECHANISM

Defining Purpose; Audience and Locale, Organizing Contents; Preparing Outline; Audio-Visual Aida; Nuance of Delivery; Body Language; Dimensions of Speech; Syllable; Accent Pitch; Rhythm; Intonation; Difference between stress and intonation; paralinguistic features of voice; Time-Dimension.

Text books:

1- Technical Communication: Principles and Practice. Meenakshi Raman and Sangeeta Sharma, Oxford University Press, New Delhi.
2- Professional Communication. Dr. Malti Agarwal, Krishna Prakashan Media (P) Ltd., Meerut.

Reference books:

1- Gerson, Sharon J. & Gerson, Steven M., Technical Writing- Process and Product , Delhi, Pearson/ Education Publications.
2- Sinha, R.P., English Grammar and Usage, New Delhi, Oxford University Press.
3- Lewis, Norman, Word Power Made Easy, Delhi, W.R. Goyal Pub.& Distributors.

BBS-104 Computer Fundamental & Office Automation

L(3)/T(1)/P(0) **Credit-4**

Objectives:

- -Give students an in-depth understanding of why computers are essential components in business, education and society.
- -Provide hands-on use of Microsoft Office

Outcomes:

- Describe the usage of computers and why computers are essential components in business and society.
- Solve common business problems using appropriate Information Technology applications and systems.
- Identify categories of programs, system software and applications. Organize and work with files and folders. Describe various types of networks network standards and communication software.

Unit-I

Introduction to Computers

Introduction, Characteristics of Computers, Block diagram of computer. Types of computers and features, Mini Computers, Micro Computers, Mainframe Computers, Super Computers.

Types of Programming Languages(Machine Languages, Assembly Languages, High Level Languages). Data Organization, Drives, Files, Directories. Types of Memory (Primary And Secondary) RAM, ROM, PROM, EPROM. Secondary Storage Devices (FD, CD, HD, Pen drive). I/O Devices (Scanners, Plotters, LCD, Plasma Display). Number Systems Introduction to Binary, Octal, Hexadecimal system Conversion, Simple Addition, Subtraction, Multiplication [8]

Unit-II

Algorithm and Flowcharts

Algorithm: Definition, Characteristics, Advantages and disadvantages, Examples Flowchart: Definition, Define symbols of flowchart, Advantages and disadvantages, Examples. [8]

Unit-III

Operating System and Services in O.S.

Dos – History, Files and Directories, Internal and External Commands, Batch Files, Types of O.S. [8]

Unit-IV

Windows Operating Environment

Features of MS – Windows, Control Panel, Taskbar, Desktop, Windows Application, Icons, Windows Accessories, Notepad, Paintbrush. [8]

Unit-V

Editors and Word Processors, Basic Concepts, Examples: MS-Word, Introduction to desktop publishing.

Spreadsheets and Database packages, Purpose, usage, command, MS-Excel, Creation of files in MS-Access, Switching between application, MS-PowerPoint. [8]

Referential Books :

1. Fundamental of Computers – By V.Rajaraman B.P.B. Publications
2. Fundamental of Computers – By P.K. Sinha
3. Computer Today- By Suresh Basandra
4. Unix Concepts and Application – By Sumitabha Das
5. MS-Office 2000(For Windows) – By Steve Sagman

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

BBS-105 Elementary Mathematics

L(3) / T(1) / P(0) **Credit-4**

Objectives:

- To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.
- To improve their ability in solving geometrical applications of differential calculus problems.
- To apply advanced Integration knowledge to Engineering problems.

Outcomes: At the end of the course, the student will be able to:

- Determine the Continuity and Differentiability of function.
- Determine the integral of different functions.
- Estimate the maxima and minima of functions.

Content:

Unit-I: CALCULUS

Limits and Derivatives:

Derivative introduced as rate of change both as that of distance function and geometrically, intuitive idea of limit. Definition of derivative, relate it to slope of tangent of the curve, derivative of sum, difference, product and quotient of functions. Derivatives of polynomial and trigonometric functions. [8]

Unit-II :Continuity and Differentiability: Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit function. Concept of exponential, logarithmic functions and their derivative. Logarithmic differentiation. Derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretations. [8]

Applications of Derivatives:

Applications of derivatives: rate of change, increasing/decreasing functions, tangents & normals, approximation, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate BBSic principles and understanding of the subject as well as real-life situations). [8]

Unit – III:Integrals: Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, only simple integrals of the type to be

evaluated. Definite integrals as a limit of a sum, Fundamental Theorem of Calculus (without proof). BBSic properties of definite integrals and evaluation of definite integrals. [8]

Unit – IV:Applications of the Integrals: Applications in finding the area under simple curves, especially lines, areas of circles/parabolas/ellipses (in standard form only), area between the two above said curves (the region should be clearly identifiable). [8]

Unit –V : Permutations and Combinations and Probability

Permutations & Combinations: Fundamental principle of counting. Factorial *n.* (*n!*) Permutations and combinations, derivation of formulae and their connections, simple applications. [8]

Recommended Textbooks.

1) Mathematics Part I - Textbook for Class XI, NCERT Publication

2) Mathematics Part II - Textbook for Class XI, NCERT Publication

Reference books:

1) Higher engineering mathematics by B.V.Ramana (Tata Macgraw Hill)

2) Advanced modern engineering mathemtics by Glyn james (pearson education

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

BBS-151 Chemistry Lab

L(0) / T(0) / P(2) **Credit-1**

List of Experiments

1. Element detection and functional group identification in organic compounds.
2. Purification of organic compound (Naphthalein).
3. To determine the strength of oxalic acid solution by titrating its against $KMnO_4$ solution.
4. Determination of solubility of salt (NaCl) at room temperature.
5. To determine the hardness of water by EDTA.
6. Determination of iron content in the given water sample by Mohr's methods.
7. Determination of available chlorine in bleaching powder.
8. Determination of neutralization equivalent of a given acid.
9. To determine the viscosity of a given solution.
10. To determine the alkalinity of water.

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

BBS-152 Office Automation Lab

L(0) / T(0) / P(2) **Credit-1**

List of experiments

CYCLE-1 (MS-word & MS-EXCEL)

1. Features of office automation.
2. Creating a new document and perform the various formatting operation in MS-Word.
3. Create a mail merge operation using MS-Word.
4. Create a table using MS-Word.
5. Perform the paragraph alignment in MS-Word.
6. Create a work sheet in MS-Excel.
7. Create various charts in MS-Excel.
8. Perform statistical operations in MS-Excel.
9. Perform various text operations in MS-Excel.

CYCLE-II(MS-Access & MS-PowerPoint)

10. Create a mark sheet data base in MS-Access . 11.Creating a pay-bill database in MS-Access
11. Update a pay-bill database in MS-Access
12. Viewing a Pay-bill database in MS-Access.
13. Generating forms and reports in MS-Access.
14. Inserting pictures, clipart, audio and video slideshow using MS-PowerPoint.
15. Customizing Animation using MS-PowerPoint.EX.NO: 1 FEATURES OF OFF

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

FIRST YEAR- 2nd Semester

BBS-201 Chemistry-II

L(3)/ T(1) / P(0) **Credit-4**

Objectives:

- To be familiarised with the emerging areas of Chemistry and their applications in various spheres of Chemical sciences and to apprise the students of its relevance in future studies.

Outcomes: At the end of the course, the student will be able to:

- Know about characteristics of gases, various gas laws and comprehensive knowledge of the kinetic theory of gases, ideal and real gas behavior
- Understand the concept of preparing various standard solutions, the colligative properties and also abnormal behaviour of solution
- Understand rate of the reaction, and the factor involved in the every chemical reactions
- Basic concepts of electrochemistry and its applications
- Gather the knowledge in basic concepts of thermodynamics
- Know the difference between solution, colloid and suspension, different types and properties of colloidal solution

Content:

Unit I:

General characteristic of gases, gas law, Boyle's law, Charle's law, Gay-Lussac's law, the gas equation, Avogadro's hypothesis, mole concept, Dalton law of partial pressure, Graham's law of diffusion, kinetic molecular theory of gases, ideal and real gases. [8]

Unit II:

Solution, concentration of solution, normality, equivalent weight, molarity, formality, molality, solutions of gases in gases, mole fraction, Grams per ml, colligative properties, abnormal behavior of solutions, Vant Hoff factor. [8]

Unit III:

Rate, order and molecularity of reaction, Integrated rate equation of zero order, first order and second order reactions, activation energy. Electrolysis, electrochemical cells, electrode potential, electrochemical series, electrode potentials and electrolyte concentration. [8]

Unit IV:

Thermodynamics: Types of thermodynamic systems,equilibrium and nonequilibrium state,reversible and irreversible process, Nature of heat and work,internal energyFirst law of thermodynamics, thermochemistry, enthalpy of reactions. [8]

Unit V:

True solution, colloidal solution and suspension, types of colloidal systems, classification of colloids,properties of colloidal system, co-agulation of colloidal solution, protective colloids, Phase Rule and its application to one component system (water). [8]

Recommended Text/Reference Books

1. Rakshit, P. C. "Physical Chemistry"
2. Atkin, P. W. "Physical Chemistry"
3. Laidler, K. J. "Kinetics and Mechanism"
4. Frost & Pearson, "Chemical Kinetics"

BBS-202 BIOCHEMISTRY

L(3) / T(1) / P(0) **Credit-4**

Objectives:

- To understand the structural and functional role of bio molecules in human beings.

Outcomes:

- The students shall be able to know the various physicochemical roles of biological molecules in the living beings.
- The students shall also be able to understand structural and functional relevancy of biochemical mechanisms.
- The students shall also be able to understand the bio chemical pathway and their regulatory mechanism.

Content:

Unit I.

Introduction to biochemistry and biomolecules, Chemical foundation of biology- p^H, dissociation constant of acid and Base, acids ,Base and buffers, role of water. [8]

Unit II.

Classification and properties of amino acids Classification Based on structure and functions, Ramachandran plot, structural organization of proteins (primary, secondary, tertiary and quaternary structures). Biosynthesis of amino acids, oxidation of amino acids and urea cycle. [8]

Unit III.

Structures, properties and classification, carbohydrates as a source of energy ,Metabolism of carbohydrate- Glycolysis , TCA cycle, ETS, Gluconeogenesis, Feeder pathways, secondary pathways of glucose oxidation- ppp & glucoronic acid pathway &, Glyoxylate cycle. [8]

Unit IV.

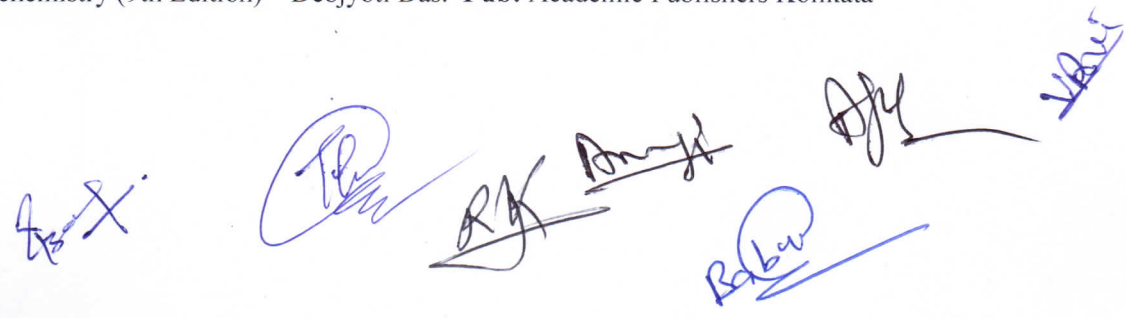
Structure, properties, classification and functions of lipids, Metabolsm of fatty acids- beta oxidation of saturated, unsaturated (mono & poly), odd and even chain fatty acids, Structure of porphyrin. [8]

Unit V.

Water soluble and fat-soluble vitamins. Dietary source. Steroid hormones – structure and importance in brief, Phytohormones and their roles. [8]

Books Recommended:

1. Harper's Illustrated Biochemistry, (26th Edition) – R.K. Murray, D.K. Garner, P.A. Mayers & V.W. Rockwell, **Pub:** McGraw Hill International Edition.
2. Principles of Biochemistry (4th Edition) – Lehninger, Nelson & Cox. **Pub**: Macmillan
3. Biochemistry (3rd Edition) – G. Zubay., **Pub**: Wm. C. Brown Pub.
4. General Biochemistry (5th Edition, 1996) – Weil, **Pub**: New Age Intl. Ltd.
5. Biochemistry (5th Edition) – Lubert Stryer. **Pub:** W.H. Freeman & Com., NY.
6. Biochemistry – D. Voet and J.G. Voet **Pub:** John Willy & Sons
7. Biochemistry (4th Edition, 1974) – West & Todd **Pub**: Oxford IBH,
8. Biochemistry (9th Edition) – Debjyoti Das.–**Pub:** Academic Publishers Kollkata



BBS-203: Cell Biology

L(3) / T(1) / P(0) **Credit-4**

Objectives:

- To understand the structural and functional role of cells and sub cellular organelles in human beings.

Outcomes:

- The students shall be able to know the various physicochemical roles of sub cellular organelles in living beings.
- The students shall also be able to understand structural and functional relevancy of sub cellular coordination.
- The students shall also be able to understand the bio chemical pathway and their regulatory mechanism of membrane transport.
- The students shall also be able to know the various organic evolutions taken place on our earth.

Content:

Unit-1 The evolution of the Cell:

From molecules of the First Cell, From Prokaryotes to Eukaryotes, From Single Cell to multicellular Organisms, Cell theory, Detailed account on prokaryotic & eukaryotic cell. Differences between animal and plant cell.

How cells are studies/Approaches for studying cells:

Light and electron microscopes, Imaging techniques, Isolation of cells and cell/tissue culture, Fractionation of cells and analysis of their molecules, Tracing and imaging molecules inside cells. [8]

Unit II The structure of cellular organelles:

Plasma membrane, cell wall, cytoskeleton their structural organization and extra cellular matrix .Mitochondria, chloroplast, ribosomes , lysosome , nucleus, and other organelles and their organization.[8]

Unit III 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 transitional import of proteins to mitochondria lysosomes, nucleus, secretary vesicles, chloroplast and peroxisomes.[8]

Unit IV Cellular responses to environmental signals in bacteria, plants and animals-mechanism of signal transduction .

Cell cycle – molecular events and regulation, Cell division(mitosis& meiosis).[8]

Unit V Cellular Basis of differentiation and development –

cell division, gametogenesis and fertilization, differential gene activity and cell differentiation, morphogenetic determinants in egg cytoplasm, genetic regulation of early embryonic development in Drosophilla, homeotic genes.[8]

Books Recommended:

1. The Cell - A molecular approach, (3rd Edition.), G.M. Cooper & R. E. Hausman, **Pub:** ASM Press Washington D.C.

2. Molecular Biology of The Cell, (4th Edition) – Bruce Albert, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts & Peter Walter, **Pub**: G.S. Garland Science Taylor & Francis Group NY 10001-2299

3. Cell and Molecular Biology, (3rd Edition) – G. Karp, **Pub**: Johnwiley & Sons, Inc. NY

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

BBS-204 Microbiology

L(3) / T(1) / P(0) **Credit-4**

Objectives:

- To understand the structural and functional role of microorganism with respect to living beings and their environment.

Outcomes:

- The students shall be able to know the various physicochemical history logical perspectives of microbes.
- The students shall also be able to understand structural and functional role of microbes for human beings.
- The students shall also be able to understand the bio chemical pathway and disease susceptibility of microbes.
- The students shall also be able to know the various types of pathogens and their control measures.

Content:

Unit I:

Introduction to Microbiology: History, scope and development of Microbiology; Applications of Microbiology in human welfare. Development of Microbiology in India & Abroad: Antony van Leeuwenhoek, Alexander Fleming, Edward Jenner, Louis Pasteur, Robert Koch, Selman Waksman, Joseph Lister, A M Chakrrobarti etc. [8]

Unit II:

Culture techniques, Physical and chemical methods of sterilization. Diversity of Microbial World: Classification, general characteristics and structure of Bacteria-(eubacteria & archaebacteria), Cyanobacteria, Actinomycetes, Mycoplasma, Rickettsia & Chlamydia with emphasis on function of each part & components. [8]

Unit III:

Diversity of Microbial World: Classification, general characteristics, structure with emphasis on Mucor, Rhizopus, Puccinia, Cercospora, Aspergillus, Penicillium Alternaria and Curvularia, function of each part & components of cell. Reproduction & economic importance of Fungi. [8]

Unit IV:

Diversity of Microbial World: Classification, general characteristics and structure of Viruses (Prions, Virions, Virusoids & Viroids) Virus host, General features of virus reproduction. DNA & RNA Viruses with the example of T4, TMV & Pox Virus. [8]

Unit V:

Growth and growth measurement: Definition of growth, mathematical expression of growth. Growth curve, Growth yield, Effect of nutrient concentration on growth. Factors affecting growth: nutrients, temperature, oxygen, pH, osmotic pressure. Measurement of growth; general introduction of synchronous culture, continuous culture and batch culture. [8]

Recommended Text/Reference Books

1. Sharma, P.D. (2005) 2nd Ed. Microbiology, Rastogi Publications.

2. Pelczar M. J., E. C. S. Chan and N. R. Krieg (2003) Microbiology, 5th Ed.; Tata McGraw Hill Publishing.

3. Dubey R. C. and D. K. Maheshwari (2004). A Text book of microbiology, 1st Ed.; S. Chand and Company Ltd.

4. H.C. Dube (2005) A Textbook of Fungi, Vikas Publishing House.

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

BBS-205 Biophysical tools & techniques

L(3) / T(1) / P(0) **Credit-4**

Objectives:

- To understand the role of various biological tools and techniques in biotechnology.

Outcomes:

- The students shall be able to know the various microscopic techniques for microbial examination.
- The students shall also be able to understand the use of chromatography and centrifugation in biotechnology.
- The students shall also be able to understand the significance of spectroscopy in molecular visualization.
- The students shall also be able to know the various types electrophoretic techniques for molecular separation..

Content:

Unit I:

Microscopy(Principal and application),Light microscopy, Phase contrast microscopy, florescence and electron microscopy (TEM and SEM). [8]

Unit II:

Chromatography technique: Paper chromatography, thin layer chromatography, column chromatography, gas chromatography, affinity chromatography, ion exchange chromatography, gel filtration. [8]

Unit III:

Electrophoresis: SDS-polyacrylamide gel electrophoresis, agarose gel electrophoresis, immunoelectrophoresis, isoelectric focusing. [8]

Unit IV:

Instruments, Basic principle and usage: pH meter, absorption and emission spectroscopy, principle and law of absorption and radiation, use of densitometry, fluorimetry, colorimetry, spectrophotometry (UV, visible and IR), manometry, paleography, centrifugation (rpm and G, ultracentrifugation), atomic absorption, IR, NMR, fluorescence, X-ray crystallography. [8]

Unit V:

Radioisotope tracer technique, importance in biological studies, measures of radioactivity, autoradiography. [8]

Recommended Text/Reference Books

1. Instrumental Methods of Chemical Analysis: Gurdeep R. Chatwal; 7 Sham K. Anand; Himalaya Publishing House.

2. Instrumental Methods of Analysis: Hobert, Willard, Merritt & Dean; CBS Publishers and Distributers;

1992

3. Instrumental Methods of Analysis:Ewing; 1992.

4. Introduction to Biophysics: Pranab Kumar Banerjee; S.Chand Publications; 2008

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

BBS-251Cell Biology Lab

L(0) / T(0) / P(2) **Credit-1**

1. Identification and staining of different types of cells.
2. Measurement of various Cell Organelles.
3. Lipid Solubility of Membranes.
4. Determination of Osmosis
5. Determination of Pinocytosis process
6. Isolation of Chloroplasts from spinach Leaves.
7. Detection of Mitosis with the help of microscope.

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

BBS-252: Microbiology Lab

L(0) / T(0) / P(2) **Credit-1**

1. Microscopy

2. Sterilization, disinfection, safety in microbiological laboratory.

3. Preparation of media for growth of various microorganisms.

4. Identification and culturing of various microorganisms.

5. Staining and enumeration of microorganisms.

6. Growth curve, measure of bacterial population by turbidometry and studying the effect of temperature, pH, carbon and nitrogen.

(Convener)

Signature.....

Name : Ajit P. Singh Yadav

Date:

Internal Members

Signature 1.....

Name : Mr. Anjani kumar Srivastava

Date:

Signature 2.....

Name : Mr. Vachaspati Rao

Date:

Signature 3.....

Name : Mrs. Rati Bajpai

Date:

Signature 4 .....

Name : Ms. Tanima Hajra

Date:

External Members

Signature 1.....

Name : Prof. (Dr.) R. K. Mishra

Date:

Signature 2.....

Name : Dr. G. Sunil Babu

Date:

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Second Year- 3rd Semester

BBS-301 ENZYMOLOGY

L T P **Credit-4**

3 1 0

OBJECTIVE:

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:

Enzymes play a very role in the world. They act as a catalyst for a chemical reaction, whether that reaction involves the execution of DNA for the purpose of cell repair or for the digestion of any types of meat as well as poultry.

CONTENTS:

Unit-I: **8 Hours**

Historical perspective, Enzyme Classification, Enzyme Chemistry: Subcellular Distribution of Enzymes. Isolation and Purification of Enzymes, Criteria for Enzyme homogeneity, General Properties, Enzyme Activity , Specific Activity and Turnover Number, Marker Enzymes. [8]

Unit-II: **8 Hours**

Enzyme Kinetics: Enzyme-Substrate Interaction, ES Complex, Binding Site, Active Site. Specificity, Steady-State, Pre-Steady State and Equilibrium-State Kinetics, Michael- Menten Equation and its derivation, Graphical Methods for determination of Km,. Vmax. Significance. Enzyme Inhibition and Activation: types of inhibition, and activation,

Competitive non-competitive and Uncompetitive inhibitors, Determination of Ki, Suicide Inhibitors. [8]

Unit-III: **8 Hours**

Mechanism of Enzyme action: enzyme-substrate complementarity, Stereochemistry of enzyme substrate action, Interaction between enzyme and substrate- lock and key model, induced fit model. Factors associated with catalytic efficiency.

Enzyme regulation: Partial proteolysis, Phosphorylation, disulphide reduction, Allosteric and Hysteric Enzymes, Proenzymes-Zymogens and activation. [8]

Unit IV: **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. [8]

Unit V: **8 Hours**

Isoenzyme, Ribozymes, Abzymes. Industrial, Agricultural and Clinical Applications of Enzymes: Comprehensive Account. [8]

Recommended Text/Reference Books

1. Alan Fersht: Structure and Mechanism in Protein Science, 2nd ed. W.H. Freeman & Co.
2. Nicolas Price & Lewis Stevens: Fundamentals of Enymology, 2nd edition, Oxford Univ. Press, New York,
3.Trevor Palmer: Understanding Enzymes, Second Edition, J. Wiley & Sons, New York.
4. Donald Voet& Judith Voet: Biochemistry, J. Wiley & Sons, New York
5. Geoffrey Zubay (1993): Biochemistry, 3rd edition, Wm. C. Brown, Oxford
6. Berg, Tymoczo and Stryer: Biochemistry

BBS-302: PLANT PHYSIOLOGY

L T P **Credit-4**

3 1 0

OBJECTIVE:

Plant Physiology is an fundamental subject to know and understand the basic reaction nature and metabolism of plants.

OUTCOMES:

Physiology is extremely important this determines how well new cultivars can handle stresses like drought, salinity, heat, etc. Also yield improvements are also tracked in this manner. Plant physiology explains how plants function in all environments.

CONTENT:

Unit-I: **8 Hours**

Plant and water relationship, colligative properties of water, free energy concept. Water uptake, conduction, transpiration, mechanism and its regulation by environmental variables. Mineral nutrition: Macro, and micronutrients, their role, deficiency and toxicity symptoms, plant culture practices, mechanism of ion uptake and translocation.

Unit-II: **8 Hours**

Photosynthesis and Chemosynthesis : photosynthetic pigments, O2 evolution, photophosphorylation, CO_2 fixation - C_3- C_4 and CAM plants.

Unit-III: **8 Hours**

Respiration: aerobic and anaerobic respiration, respiratory pathways glycolysis, krebs 'cycle, electron

transport, oxidative phosphorylation, pentose phosphate pathway, photorespiration, cyanide resistant respiration.

Unit- IV: **8 Hours**

Growth: general aspects of phytohormones, inhibitors-auxins. kinetin, gibberellins, and ethylene: action and their application; photoperiodisim and vernalization. Germination, growth movements, parthenocarpy, abscission and senescence.

Unit-V: **8 Hours**

Nitrogen metabolism : atmospheric nitrogen fixation, *nif*-gene & its role, nitrogen cycle, nitrogen assimilation.

Recommended Text/Reference Books

Plant Physiology Taiz and Zeiger

Plant Physiology Salisbury and Ross

Plant Physiology By V. Verma

BBS-303 ANIMAL PHYSIOLOGY

L T P **Credit-4**

3 1 0

OBJECTIVE:

To familiarize students for cellular and molecular mechanisms to understand about nervous, muscular, cardiovascular, respiratory, renal, digestive, and endocrine physiology.

OUTCOMES:

An understanding of animal anatomy and physiology is important for people working in a range of industries, especially those working with livestock, domestic pets and wildlife. Structure anatomy deals with the different parts of the animal body, such as; cells, tissues, bone, and muscle

CONTENTS:

Unit I: **8 Hours**

Digestive system

Digestion: Introduction & component of Human digestive system, digestive enzymes, process of digestion, digestion of protein, carbohydrate and lipid .

Unit II: **8 Hours**

Circulatory & Excretory system

Blood: Composition and functions, Blood groups, Rh factor and their significance, blood clotting mechanism, anemia, heart, blood pressure and cardiac cycle, heart beat, respiratory pigments, cardiac muscle activity, hepatic portal system.

Excretion : Structure of kidney, types of nephron, mechanism of urine formation and its elimination and arginine, ornithin cycle.

Unit III: **8 Hours**

Respiratory system

Respiratory system- Respiration, Structure of lung, mechanism of breathing, respiratory volume, respiratory pigment, exchange & transport of O_2 and CO_2, Factors affecting haemoglobin affinity for O_2, CO_2 transport, Effect of P^H and CO_2 concentration on Hb-O_2 affinity

Unit IV: **8 Hours**

Nervous system & Muscle contraction

Histology of nervous tissue, classification of neuron, neuroglia, myelation, structural organization of CNS, meninges, gray and white matter.

Muscle : Structure of various types of muscles and mechanism of muscle contraction .

Unit V: **8 Hours**

Endrocrine gland & Reproductive system

Endocrine glands : Structure and functions of various endocrine glands, diseases caused by hormonal deficiency ; Mechanism of hormone action.

Reproductive process: Male and female reproductive system (structure and function) of human, gametogenesis, menstrual cycle, birth control and its types.

Recommended Text/Reference Books

Guyton and Guyton

Textbook of medical physiology by Guyton and Hall

BBS-304: 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:

Unit1: **8 Hours**

Mendelian genetics: Mendels work, Laws of heredity (Law of segregation, Law of independent assortment), ,Test cross, back cross, Mono, di and Tri hybrid cross with simple problems. Alleles ; codominant alleles, multiple alleles, Rh blood group system, lethal alleles, penetration and expressivity, probability, binomial theory and pedigree analysis.

Unit II: **8 Hours**

Interaction of genes; epistasis, dominant and recessive epistasis, dominant and recessive gene interaction, pleiotropy, genetic linkage, gene mapping in *S. cerevisiae* and *Neurospora crassa*.

Sex chromosomes and sex determination; sex chromosomes, chromosomal Basis of sex determination in humans, plants, and *Drosophila,* non chromosomal Basis of sex determination, mosaics, sex linked traits and sex linked inheritance.

Supplementary factors; Comb pattern in fowls, Complementary genes; Flower colour in sweet peas, Multiple factors – Skin colouir in human beings, Epistasis: Plumage colour in poultary Multiple allelism: Blood groups in human beings

Unit III: **8 Hours**

Sex Determination in Plants and animals, Linkage and Crossing Over: Coupling and repulsion hypothesis, Linkage in maize and Drosophilea, Mechanism of crossing over and its importance, Chromosome mapping .

Unit IV: **8 Hours**

Chromosomal Variations

A General account of structural and numerical aberrations, Chromosomal evolution of wheat and cotton Cytoplasmic Inheritance: Plastid inheritance in Mirabilis, petite characters in yeast and kappa particles in paramecium.

Human Genetics Karyotype in man, Inherited disorders - Allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal (Down syndrome and cri-du-chat syndrome).

Unit V: **8 Hours**

Mutations Types: spontaneous;s and induced, Mutagens: Physical and chemical, Mutation at the molecular level. Mutations in plants, animals, and microbes for economic benefit of man.

Text Books & References

1. Genetics- Strickberger, 2 nd.
2. Microbial Genetics – D. Frifielder.
3. Advance Genetics by G.S. Miglani, Narosa Publishing House.
4. Principle of Genetics- E.J. Gardner, M.J. Simmons and D.P. Snustad (John wiley & Sons Publication)

BBS-305: PLANT BIOTECHNOLOGY

L T P **Credit-4**
3 1 0

OBJECTIVE:

To study classical and modern plant biotechnology processes, including breeding of healthy plants, plants with improved characteristics.

OUTCOME:

The aims of applied plant science research for agriculture are to enhance crop yields, improve food quality, and preserve the environment where human beings and other organisms live. Furthermore, food quality will become more important than crop productivity in a wealthy society.

CONTENTS:

Unit I: **8 Hours**

Introductory history: Laboratory organization; Nutrition of plant cells; Media composition – solid and liquid; Biology plant cell in culture, Tissue and organ culture; Establishment and maintenance of callus and suspension cultures; Cellular differentiation and regulation of morphogenesis; Somatic embryogenesis; Control of organogenesis and embryogenesis; Single cell methods; Cytology of callus, Tissue culture & genetic engineering.

Unit II: **8 Hours**

Haploid production -Androgenesis; Anther and microspore culture; Gynogenesis; Embryo culture and rescue in agricultural and horticultural corps; Protoplast isolation; Culture – regeneration; Somatic hybrid-cybrids; *In vitro* selection of mutants –mutants for salts, disease, cold, drought, herbicide and other stress conditions; Plant micropropagation:

Application of micropropagation in forestry and historical crops, Micrografting – *in vitro* clonal multiplication – Meristem culture and virus elimination; Shoot tip culture.

Unit III: **8 Hours**

Improved crop varieties through somaclonal variation in *in vitro* cultures -- Causes- stability and utilization – genetic and epigenetic Basis; Establishment of cell lines and evaluation; Secondary metabolite in cell culture; Application of tissue culture for crop improvement in agriculture, horticulture and forestry

Unit IV: **8 Hours**

Introduction to Plant genetic Engineering: Methodology; Plant transformation with Ti plasmid of *Agrobacterium tumifacians*; Ti plasmid derived vector systems; Physical methods of transferring genes to plants - Microprojectile bombardment, Electroporation; Manipulation of gene expression in plants; Production of marker free transgenic plants.

Unit V: **8 Hours**

Developing insect-resistance, disease-resistance, herbicide resistance; stress and senescencetolerance in plants-oxidative, salt and submergance stress, fruit ripening, Genetic manipulation of flower pigmentation, Developing quality of seed storage, Provitamin A, iron proteins in rice, Modification of food plant taste and appearance, yield increase in plants, Wild plant relatives as a source of novel genes, Plants as bioreactor - antibodies, polymers, foreign proteins in seeds. Genome mapping efforts in rice & maize, potential applications.

Text Books & References

1. Principles and Practices in Plant Science. Walton, P.D. Prentice Hall 1988.
2. Plant Tissue Culture: Application and Limitations. Bhowjwani, S.S. 1990.
3. Plant Cell Culture: A practical approach. Dixon. 1994.
4. Plant Biotechnology and Development, SRC Series of Current Topics in Plant molecular Biology. Gresshoff, P.M.
5. Plant Cell Culture, Advances in Biochemical Engineering and Biotechnology. Anderson, L.A.,

6. Recombinant DNA. Watson, 1992.

7. Gene transfer to Plants. Portykns, 1995.

8. Plant Biotechnology. Mantell and Smith, 1984.

9. Genetic Engineering of Plants. Kosuge, 1983.

10. Biochemistry & Molecular Biology of Plants. Kosuge. 1983

BBS-351: ENZYMOLOGY LAB

L T P **Credit-1**

3 1 0

1. Isolation of Enzyme from different microorganism
2. Isolation of alpha amylase from plant source
3. Determination of Enzyme activity
4. Effect of pH on Enzyme kinetics
5. Effect of temperature on Enzyme kinetics
6. Identification of Enzyme by different assay
7. Purification of enzymes by different methods
8. Immobilization of Enzyme by sodium Alginate method

BBS-352: PLANT BIOTECHNOLOGY LAB

LT P **Credit-1**

3 1 0

1. Preparation of plant tissue culture media.
2. Surface sterilization.
3. Organ culture.
4. Protoplast isolation and culture.
5. Anther culture: production of haploids.
6. Cytological examination of regenerated plants.
7. Micropropagation of banana, citrus Papaya, Sugarcane etc.
8. Cell suspension culture from different tissues.
9. Artificial seed preparation
10. Cytological examination of regenerated plants
11. Transfer of plants to soil.

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Second Year- 4th Semester

BBS-401 MOLECULAR BIOLOGY

L T P **Credit-4**

3 1 0

OBJECTIVE:

Molecular biology deals with nucleic acids and proteins and how these molecules interact within the cell to promote proper growth, division, and development

OUTCOMES:

Molecular biology is a large and ever-changing discipline. This course will emphasize the molecular mechanisms of DNA replication, repair, and protein synthesis. 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 I: **8 Hours**

DNA as the genetic material: Griffiths and Hershey-Chase experiment, Central Dogma of molecular biology, structure of A, B and Z-DNA, palindromic sequences, structure of RNA (t-RNA, m-RNA and r-RNA), DNA denaturation and renaturation.

Unit2: **8 Hours**

DNA Replication: (prokaryotic and eukaryotic), Modes, Components of cellular replisomes and their functions, The replicon, types and activities associated with prokaryotic DNA polymerases and their functions. Origin of replication in prokaryotes and eukaryotes. Replication of telomeric sequences, Inhibitors of replication. [8]

Unit III: **8 Hours**

Transcription: Introduction, promoter architecture in prokaryotes and eukaryotes. SubUnit structure of prokaryotic RNA polymerase. Types of eukaryotic RNA polymerases. Stages of transcription, sequence of events in initiation of transcription in prokaryotes and eukaryotes. Elongation and termination of transcription.Introduction to other regulatory elements. mRNA Processing: Capping, cleavage and polyadenylation, splicing reaction, spliceosome, role of snRNPs. Ribozymes, Inhibitors of transcription.

Unit IV: **8 Hours**

Genetic code, wobble hypothesis, Translation: (Eukaryotic & prokaryotic), translation machinery, mechanisms of initiation ,elongation and termination, Protein localization: Synthesis of secretary and membrane proteins, import into nucleus, mitochondria, chloroplast and peroxisomes , receptor mediated endocytosis. Inhibitors of translation.

Unit V: **8 Hours**

Regulation of gene expression in prokaryotes. The operon concept. The lac and trp operons, Attenuation, antitermination and antisense RNA, Mutations: Spontaneous and induced; chemical and physical mutagens. DNA damage and repair [8]

Textbooks and references:

1. Albert B, Bray Denis et al.: Molecular Biology of The Cell, latest ed.
2. Watson, Hopkin, Roberts et al.: Molecular Biology of the Gene, 4th ed.
3. Genetics- Strickberger, 2 nd.
4. Microbial Genetics – D. Frifielder.

5. Baltimore- Molecular Biology of the Cell.

6. Benjamin Levin – Genes VIII, 8 th ed.

7. Advance Genetics by G.S. Miglani, Narosa Publishing House.

BBS: 402 ANIMAL BIOTECHNOLOGY

LT P **Credit-4**

3 1 0

OBJECTIVE:

This course deals with the details on animal biotechnology i.e. the applications of tools of molecular biology and biotechnology for the improved production and protection of animals, animal products.

OUTCOMES:

For the improvement of animal production, biotechnological techniques like embryo transfer in vitro fertilization transgenic animal, animal cloning and biopharming have been explained. Other biotechnological techniques which have been used to improve the animal production including mapping of genome and genome sequencing, marker assisted selection, gene banking, , genetic manipulation of microbes to improve feed utilization and health are also explained.

CONTENTS:

Unit I: **8 Hours**

Animal Cell Culture: Equipments and materials for animal cell culture technology. Various systems of tissue culture, their distinguishing features, advantages and limitations.

Culture medium: natural media, synthetic media, sera. Introduction to balanced salt solutions and simple growth medium. Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium, role of carbon di oxide, serum and supplements.

Unit II: **8 Hours**

Characteristics of cells in culture: Contact inhibition, anchorage dependence, cell-cell communication etc.; Cell senescence; cell and tissue response to trophic factors. Primary Culture: Behavior of cells, properties, utility. Explant culture; suspension culture. Established cell line cultures: Definition of cell lines, maintenance and management; cell adaptation.

Unit III: **8 Hours**

Measurement of viability and cytotoxicity. Cell cloning, cell synchronization and cell manipulation. Various methods of separation of cell types, advantages and limitations; flow cytometry. Scaling up of animal cell culture. Cell transformation.

Unit IV: **8 Hours**

Stem cell cultures, embryonic stem cells and their applications. Somatic cell genetics. Apoptosis: Measurement of cell death. Apoptosis (death domain, role of cytochrome C. Three dimensional cultures and tissue engineering.

Unit V: **8 Hours**

Commercial applications of cell culture: Tissue culture as a screening system; cytotoxicity and diagnostic tests. Mass production of biologically important compounds (e.g. Vaccines). Harvesting of products, purification, and assays.

Textbooks and references:

1- Ian Freshney (4th edition)
2- Buttler
3- Elements of Biotechnology by P.K. Gupta(1st edition-2000), Rastogi publication

BBS-403 BIOSTATISTICS

LTP **Credit-4**

310

OBJECTIVE:

Statistics is the science in which we make inferences about some specific random process based upon a sample of data which is sometimes quite limited.

OUTCOMES:

This course is designed to teach students the basic principles of biostatistics. It can be a first course in biostatistics for those students who will use the knowledge they acquire to enable them to continue learning more advanced techniques in future statistical and biostatistical course work. It can also serve as the necessary base course in biostatistics for those who will go no further in acquiring advanced skills in biostatistics but who can use the knowledge they acquire to intelligently read journal articles that use biostatistical methods, interact effectively with professional biostatisticians in collaborative endeavors and understand the terminology of one of the core disciplines of public health.

CONTENTS:

Unit1: **8 Hours**

Introduction to Biostatistics: definition, statistical method, Biological measurement, kinds of Biological data, function of statistics and limitation of statistics. Application of Biostatistics, Role of Biostatistics in modern research, parametric and nonparametric methods (Tests).

Unit II: **8 Hours**

Collection of data, Presentation of Data, classification and tabulation, types of representation (graphic-bar diagram, pie diagram and curves and Basic concept of calculus). Sampling and sampling design.

Unit III: **8 Hours**

Measure of central tendency, mean, Median, Mode, Geometric Mean, Measure of dispersion, Variability and changes, Deviations-quartile deviation, mean deviation, standard deviation, standard, Error, coefficient of variations.

Unit IV: **8 Hours**

Test of Hypothesis, Test of significance, chi-square test, t-test, F-test and ANOVA (Analysis of variance) One way and two way classification.

UnitV: **8 Hours**

Random experiments: outcomes, sample spaces (set representation). Events: occurrence of events, 'not', 'and' and 'or' events, exhaustive events, mutually exclusive events Axiomatic (set theoretic) probability,. Probability of an event, probability of 'not', 'and' & 'or' events.

Probability Distributions: Binomial Distribution, Poisson distribution and Normal Distribution and their Applications in Biostatistics.

Recommended Text/Reference Books

1. Georgr W and Willian G., Statistical Methods, IBH Publication

2. R. Rangaswami, A Text Book of Agricultural Statistics, New Age International Publication

3. Zar, J., Biostatistics, Prenticw Hall, London

BBS-404 BIOINFORMATICS

L T P **Credit-4**

3 1 0

OBJECTIVES:

The basic objective is to give students an introduction to the basic practical techniques of bioinformatics.

OUTCOMES:

Bioinformatics is the science of storing, extracting, organizing, analyzing, interpreting and using information. The approaches to the discipline of bioinformatics incorporate expertise from the biological sciences, computer science and mathematics.

Unit I: **8 Hours**

Introduction of Bioinformatics, Biological Data Bases. Primary and secondary data Bases. Specialized sequence data Bases of EST, TFB Sites, SNP's, gene expression. Pfam, PROSITE, BLOCK (Secondary data Bases). Data retrieval with ENTREZ, SRS, DBGET.

Unit II: **8 Hours**

Principles of DNA sequencing (chemical chain termination, Dideoxy chain termination method, Automatic sequencer). RNA sequencing. Protein sequencing (Edmand degradation method).

Unit III: **8 Hours**

Sequence alignment (pairwise and multiple, global and local). Sequence alignment algorithm (FAST, BLAST, Needleman and Wunsch, Smith Waterman). Data Bases similarity searches (BLAST, FASTA and PSI BLAST). Amino acid substitution matrices (PAM BLOSUM).

Unit IV: **8 Hours**

Protein structure prediction (Chou Fasman method) : Secondary and tertiary structures. Homology Modelling, ORF prediction, Gene prediction, Micro array data analysis. Profiles and motifs.

Unit V: **8 Hours**

Structure visualization methods (RASMOL, CHIME etc.). Protein Structure alignment and analysis. Application of Bioinformatics in drug discovery and drug designing.

Recommended Text/Reference Books

1. Bioinformatics: Principles and applications by Ghosh and Mallick (oxford) university press)
2. Bioinformatics by Andreas D Boxevanis (Wiley Interscience)
3. Fundamental concept of bioinformatics by Dan e. krane
4. Introduction to bioinformatics by Attwood and Parry Smith (Pierson education Publication)

BBS-405: Ethics, Patenting and Bio-Entrepreneurship

L T P **Credit: 4**

3 1 0

OBJECTIVE:

To study advanced biology/biotechnology with business tools and methods.

OUTCOMES:

1- One can learn what is required to translate scientific research and patents into innovative products and viable business opportUnities.

2- The teaching draws on industry experts, high quality academic faculty, real life cases, insight into bio ventures, and includes a three-month internship in one of Denmark's leading life-science companies

CONTENTS:

Unit I: **8 Hours**

Ethics: Benefits of biotechnology, ELSI of biotechnology, recombinant therapeutic products for human health care, genetic modifications and food consumption, release of genetically engineered organisms, applications of human genetic rDNA research, human embryonic stem cell research.

Unit II: **8 Hours**

Introduction to Indian Patent Law. World Trade Organization and its related intellectual property provisions. Intellectual/Industrial property and its legal protection in research, design and development.

Unit III: **8 Hours**

Patenting in Biotechnology, economic, ethical and depository considerations. Patentable subject matter and legal aspects of transfer of Biotechnology in India. Writing a patent specification. Information sources in Patent Literature search.

Unit IV: **8 Hours**

Entrepreneurship definition, factors necessary for entrepreneurship, desirables in a startup, mistakes to be avoided, pillars of bio-entrepreneurship, promoting bio-entrepreneurship, biotech company roadmap, legal, regulatory and other business factors

Unit V: **8 Hours**

Funding of biotech business(Financing alternatives, VC funding, funding for biotech in India, Exit strategy, licensing strategies, valuation), support mechanisms for entrepreneurship (Bio-entrepreneurship efforts in India, difficulties in India experienced, organizations supporting biotech growth, areas of scope, funding agencies in India, biotech policy initiatives).

Recommended Books:

1. Innovation and Entrepreneurship in Biotechnology, An International Perspective Damian Hine, John Kapeleris Edward Elgar Publishing Limited Northampton Massachusetts USA.
2. Agriculture and Intellectual Property Rights: Economic, Institutional and Implementation Issue in Biotechnology. V Santaniello, R E Evenson, d Zilberman, G A Carlson.

BBS-451 MOLECULAR BIOLOGY LAB.

L T P
0 0 2 **Credit-1**

1. Estimation of DNA content in the given sample by diphenylamine method.
(Nitrogen cylinders, -200C 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.
7. Purification of DNA through columns.

(Sorval, Cyclomixer, Electrophoresis Units both vertical & horizontal, transillulminator, U.V. Torch, Gel documentation system, Thermal cycler etc.)

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

BBS-453 BIOINFORMATICS LAB

L T P

0 0 2 **Credit-1**

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

(Convener)

Signature.....

Name : Ajit P. Singh Yadav

Date:

Internal Members

Signature 1.....

Name : Mr. Anjani kumar Srivastava

Date:

Signature 2.....

Name : Mr. Vachaspati Rao

Date:

Signature 3.....

Name : Mrs. Rati Bajpai

Date:

Signature 4 .....

Name : Ms. Tanima Hajra

Date:

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

External Members

Signature 1.....

Name : Prof. (Dr.) R. K. Mishra

Date:

Signature 2.....

Name : Dr. G. Sunil Babu

Date:

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Third Year- 5th Semester

BBS-501 GENETIC ENGINEERING

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 I: **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 vector, PBR322, Bacteriophage-λ, M-13 and other phage vectors; Cosmids, Phagemids; YAC and BAC, Expression vector.

Unit II: **8 Hours**

Restriction modification, enzymes used in recombinant DNA technology Endonucleases, ligases and other enzymes useful in gene cloning.

Unit III: **8 Hours**

PCR technology, types of PCR for gene/DNA detection, cDNA Gene library: Construction cDNA library and genomic library, screening of gene libraries – screening by DNA hybridization, Selectable markers.

Unit IV: **8 Hours**

Preparation and application of molecular probes: DNA probes, RNA probes, Radioactive labeling, Non radioactive labeling, use of molecular probes, DNA fingerprinting. Southern blotting, Northern blotting, Western blotting, In-situ hybridization. Colony and plaque hybridization. RFLP, AFLP, RAPD, SNP, Dot Blot, Microarray Technology.

Unit V: **8 Hours**

Cloning of sheep (Dolly) & other mammals; applications in conservation; therapeutic vs. reproductive cloning; ethical issues and the prospects for human cloning.

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

BBS-502: ENVIRONMENTAL SCIENCE

LTP **Credit-4**

3 1 0

OBJECTIVE:

The objective of the Environmental Studies is to study the concept of sustainability in an integrated way, including environmental, economic, and social aspects.

OUTCOMES:

Environmental science also branches out into environmental studies and environmental engineering. It provides integrated and interdisciplinary approach to the study of environmental problems. Environmental studies are the study of social sciences to understand human interactions with the environment

CONTENTS:

Unit I: **8 Hours**

Environmental Sciences: Introduction, definition, Scope, Importance, Need for Public Awareness Natural Resources: Renewable and non Renewable recourses, Biogeochemical Cycles Ecological Succession, Ecological pyramids. [8]

Unit II: **8 Hours**

Concept of an Ecosystem: Structure and function of an ecosystem ,Producers, consumers and decomposers, Energy flow in the ecosystem ,Ecological succession, Food chains, food webs and ecological , pyramids , Introduction, types, characteristic features, structure and function of the following ecosystem. Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, ocean). [8]

Unit III: **8 Hours**

Environmental pollution and pollutants, Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution, Solid waste management: Causes, effects and control measures of urban and industrial wastes. [8]

Unit IV: **8 Hours**

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

Unit V: **8 Hours**

Global warming, acid rains, depletion of ozone layer population growth the population explosion, family welfare |Program, human rights, Biofertilizers, Biopesticides vermicomposting.

Recommended Text/Reference Books

1. Environmental studies By Dr. S.K. Dhameja
2. Environmental & Ecology P.K. Agrawal
3. Environmental & Ecology Deswal & Deswal
4. BBSic concepts and applications in environment Indusekher Thakur

BBS-503 IMMUNOLOGY

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:

Immunology 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 I: **8 Hours**

History & phylogeny of Immune system. Types of immUnity. Cells & organs of the immune system. Structure and function of immunologlobins. Nature of antigens, antigenicity and immunogenicity. Lymphocyte traffic.

Unit II: **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 III: **8 Hours**

Immunological tolerance. Induction of tolerance; T- cell anergy; 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 IV: **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 V: **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 books:

1. Immunology by Kuby (Free man publication)
2. Immunology by C. Fatima
3. Immunology and immunotechnology by Ashim k. Chakravarty (Oxford university Press)

BBS-551 IMMUNOLOGY LAB

L T P **Credit-1**

3 1 0

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.

BBS-552 MINI PROJECT WORK AND PRESENTATION

Students have to perform a mini project work related to their respective stream in B. Sc. The project work may be software or hardware based. It may be extendable to major project.

Rama University Uttar Pradesh, Kanpur

Faculty of Sciences

Third Year- 6th Semester

BBS-601 INDUSTRIAL BIOTECHNOLOGY

L T P **Credit-4**

3 1 0

OBJECTIVE:

The course aims to provide fundamental insights to exploit enzymes and microbes for the manufacturing of products which have a huge industrial significance. The course majorly focusses on the applications and allows students to gain practical knowledge rather than mere theory.

OUTCOMES:

Industrial biotechnology is the application of biotechnology for industrial purposes, including manufacturing, alternative energy and biomaterials. ... (Industrial Biotechnology) is four years duration course. It is an important one which provides many job opportUnities to the candidates in the field of industry.

CONTENTS:

Unit-I: **8 Hours**

Introduction to Industrial Biotechnology/Microbiology: Brief History and Developments in Industrial Biotechnology/Microbiology, techniques of microbial culture, growth media, sources of nutrition, maintenance of microbial culture and strain preservation.

Unit-II: **8 Hours**

Improvement of Industrial Strains: mutation, genetic engineering techniques, preservation of cultures-storage on agar slants, soil culture, lyophilization, storage in liquid nitrogen. [8]

Unit-III: **8 Hours**

Fermentation: Brief introduction, Types of fermenter-aerated and agitated fermenter, Basic function of Baffle, Impeller and Sparger.

Unit-IV: **8 Hours**

Down stream processing: Solid-liquid separation, flotation, flocculation, filtration, centrifugation, cell disruption, concentration, evaporation, liquid-liquid extraction, membrane filtration, precipitation, adsorption. Product purification by chromatography.

Unit-V: **8 Hours**

Industrial process of beverages – enzymes, amino acid - organic acids - organic solvents antibiotics. Introduction to nanotechnology-history and recent developments sources of nanoparticles - microbial production of nanoparticles - advantages of microbial nanoparticles applications.

RECOMMENDED BOOKS –

1. Murray Moo -Young, Comprehensive Biotechnology, Vol. 1 & III-latest ed. 45
2. Microbes & Fermentation, A. Lel and Kotlers Richard J. Mickey, Oriffin Publication
3. Industrial Fermentations- Leland, N. Y. Chemical Publishers.
4. Prescott and Dunn's- Industrial Microbiology, 4th, ed.
5. Fundamentals of Biotechnology, Prave. P. Faust, V. Sitih. W., Sukatsh, DA, 1987. ASM press.

BBS-602 CELL AND TISSUE CULTURE TECHNIQUES

L T P **Credit-4**

3 1 0

OBJECTIVE:

To learn and study the practical skills in plant and animal anatomy and physiology

OUTCOMES:

This course provides knowledge of and expertise in animal and plant tissue culture theory and practice. This course has a vocational focus and introduces you to the theory and practice of animal and plant tissue culture with their role and applications in biotechnology and biochemical research. The topics covered in this course include media preparation, sterile techniques, aseptic handling, initiation and routine maintenance of cells in culture, common contaminants of plant and animal cell culture, and understanding of some of the applications of cell culture technology e.g. somatic cell and protoplast fusion; Hybridoma technology.

Unit I: **8 Hours**

Plant Tissue Culture: Introductory History – Concepts of Cell theory &Cellular totipotency, Milestones in plant tissue culture; Infrastructure & Organization of plant tissue culture laboratory – General & aseptic laboratory, different work areas, equipments& instruments required, other requirements

Aseptic Techniques: Washing & preparation of glassware, packing & sterilization, media sterilization,surface sterilization, aseptic work station, precautions to maintain aseptic conditions.

Culture Medium: Nutritional requirements of the explants, PGR 's & their*in vitro* roles, media preparation; 'Explant' for plant tissue culture – histological and/or cellular characteristics Response of explants *in vitro* – Dedifferentiation and redifferentiation.

Callus Culture Technique – Introduction, principle,protocol, factors affecting, Morphology & internal structure, genetic variation.

Unit II: **8 Hours**

Suspension and Organ Culture Techniques: Introduction, Principle, Protocols, Types, Growth measurement and synchronization.

Anther and Pollen Culture Techniques: Introduction, principle, protocol, factors affecting ovary, ovule, embryo and endosperm culture.

Somaclonal Variation: Introduction, terminology, origin, selection at plant level, selection at cell level, mechanism assessment.

Unit III: **8 Hours**

Protoplast: Protoplast isolation, protoplast culture; Somatic hybridization – Protoplast fusion techniques, selection of hybrids, production of symmetric & asymmetric hybrids & cybrid production; Genetic transformations – DNA uptake by seeds, pollens, transformation of protoplasts, agrobacterium mediated transformations; Direct DNA ransfer methods – electroporation, microprojectile bombardment, microinjection, use of marker genes, integration & expression of foreign DNA. Secondary metabolite production (*in vitro*), Biotransformations: Introduction, principle, optimization of yield.

Unit IV: **8 Hours**

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 medium and role of serum. Biology and characterization of the cultured cells and maintenance of cell culture. Cell separation, Scaling –up of animal cell culture.

Unit V: **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. Role of maternal contribution in early embryonic development.

Recommended Text/Reference Books

1. Animal Tissue culture : J. Paul
2. Introduction to Plant Tissue culture : M.K. Razdan
3. Plant Tissue Culture : Theory & Practice : S.S. Bhojwani & M.K. Razdan
4. Micropropagation :Debergh& Zimmermann
5. Plant tissue culture :KalyankumarDey

BBS-651 MAJOR PROJECT WORK AND PRESENTATION

A group of students have to make a latest technology based project in their respective stream. It may be hardware or software based.

BBS-652 SEMINAR

Students have to deliver presentations on research & recent technologies with respect to his/her course.

(Convener)

Signature.....
Name : Ajit P. Singh Yadav
Date:

Internal Members

Signature 1.....
Name : Mr. Anjani kumar Srivastava
Date:

Signature 2.....
Name : Mr. Vachaspati Rao
Date:

Signature 3.....
Name : Mrs. Rati Bajpai
Date:

Signature 4 .....
Name : Ms. Tanima Hajra
Date:

External Members

Signature 1.....
Name : Prof. (Dr.) R. K. Mishra
Date:

Signature 2.....
Name : Dr. G. Sunil Babu
Date: