RAMA UNIVERSITY UTTAR PRADESH

Faculty of Sciences, Kanpur

SYLLABUS & EVALUATION SCHEME

[Effective from the Session 2014-15]

B. Sc. (Hons.) Biotechnology

1st, 2nd, & 3rd Year

RAMA UNIVERSITY UTTAR PRADESH, KANPUR

A meeting of the Board of Studies of the Department of Biotechnology of Faculty of Sciences, Rama University Uttar Pradesh, Kanpur was held on 5th July 2014 at 11 AM. The following members were present:

1.	Dr. Ajay Kumar	Convener
2.	Mr. Ajit Pratap Singh Yadav	Member
3.	Mr. Vachaspati Rao	Member
4.		External Member
5.		External Member

The quorum of the meeting was complete.

Agenda of the meeting:

1. Assessment Criteria
2. Question Paper Format
3. Syllabus

The meeting resolved unanimously that attached Assessment Criteria, Question Paper Format and Syllabus are justified and approved.

Convener

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

Internal Members

Signature:	1…….	2……
Name:	Mr. Ajit Pratap Singh Yadav	Mr. Vachaspati Rao
Date:		

External Members

Signature:	1……	2……
Name:	Prof. (Dr.).	Dr.
Date:		

Faculty of Sciences

Rama University Uttar Pradesh, Kanpur

Course Detail and 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**

For Continuous Evaluation (CE) is such as: 30 Marks
Conduct / Perform/Execution /Practical File/ Viva-Voice
MTE - Mid Term Examination: 20 Marks
   a. First Mid Term Examination: 10 marks
   b. Second Mid Term Examination: 10 marks
ETE - End Term Examination: 50 Marks

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

Internal Members
Signature: 1……. 2……
Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao
Date:

External Members
Signature: 1…… 2……
Name: Prof. (Dr.). Dr.
Date:

Faculty of Sciences

Rama University Uttar Pradesh, Kanpur

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

MTE - Mid Term Examination: 20 Marks
   a. First Mid Term Examination: 10 marks
   b. Second Mid Term Examination: 10 marks
ETE - End Term Examination: 60 Marks

- **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks
Conduct / Perform/Execution /Practical File/ Viva-Voice
MTE - Mid Term Examination: 20 Marks
   a. First Mid Term Examination: 10 marks
   b. Second Mid Term Examination: 10 marks
ETE - End Term Examination: 50 Marks

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

Internal Members
Signature: 1……. 2……
Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao
Date:

External Members
Signature: 1…… 2……
Name: Prof. (Dr.). Dr.
Date:

Faculty of Sciences

Rama University Uttar Pradesh, Kanpur

Course Detail and 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**

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

Evaluation Scheme:

- **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks
1. Attendance: 5 Marks
2. Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks
   a. First Mid Term Examination: 10 marks
   b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

- **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks
Conduct / Perform/Execution /Practical File/ Viva-Voice
MTE - Mid Term Examination: 20 Marks
   a. First Mid Term Examination: 10 marks
   b. Second Mid Term Examination: 10 marks
ETE - End Term Examination: 50 Marks

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

Internal Members
Signature: 1……. 2……
Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao
Date:

External Members
Signature: 1…… 2……
Name: Prof. (Dr.). Dr.
Date:

Faculty of Sciences

Rama University Uttar Pradesh, Kanpur

Course Detail and 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**

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

Evaluation Scheme:

- **Course without practical components**

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

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

MTE - Mid Term Examination: 20 Marks

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

ETE - End Term Examination: 60 Marks

- **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks
Conduct / Perform/Execution /Practical File/ Viva-Voice
MTE - Mid Term Examination: 20 Marks

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

ETE - End Term Examination: 50 Marks

Convener

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

Internal Members

Signature: 1……. 2……
Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao
Date:

External Members

Signature: 1…… 2……
Name: Prof. (Dr.). Dr.
Date:

Faculty of Sciences

Rama University Uttar Pradesh, Kanpur

Course Detail and 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**

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 : Dr. Ajay Kumar
Date :

Internal Members

Signature: 1……. 2……
Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao
Date:

External Members

Signature: 1…… 2……
Name: Prof. (Dr.). Dr.
Date:

Faculty of Sciences

Rama University Uttar Pradesh, Kanpur

Course Detail and 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**

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

Evaluation Scheme:

- **Course without practical components**

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

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

MTE - Mid Term Examination: 20 Marks

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

ETE - End Term Examination: 60 Marks

- **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks
Conduct / Perform/Execution /Practical File/ Viva-Voice
MTE - Mid Term Examination: 20 Marks

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

ETE - End Term Examination: 50 Marks

Convener

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

Internal Members

Signature: 1……. 2……
Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao
Date:

External Members

Signature: 1…… 2……
Name: Prof. (Dr.). Dr.
Date:

First year-1st Semester

BBS-101: Chemistry-I

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

Unit 1:

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 2:

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 3:

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

Unit 4:

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 5:

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 T P **Credit: 4**
3 1 0

Unit 1:

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]

Unit2:

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 3:

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 4:

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 5:

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 T P **Credit: 4**
3 1 0

UNIT- 1:

Fundamentals of communication 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. [8]

UNIT-2:

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. [8]

UNIT-3:

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. [8]

UNIT-4:

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. [8]

UNIT-5:

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. [8]

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

BBS-104: Computer Fundamental & Office Automation

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

UNIT-1:

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-2:

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

UNIT-3:

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

UNIT-4:

Windows Operating Environment

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

UNIT-5:

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]

Recommended Text/Reference 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

BBS-105: Elementary Mathematics

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

UNIT-1:
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-2:
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 – 3:
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 – 4:
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 –5 :
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 Text/Reference Books:

1. Mathematics Part I - Textbook for Class XI, NCERT Publication
2. Mathematics Part II - Textbook for Class XI, NCERT Publication
3. Higher engineering mathematics by B.V.Ramana (Tata Macgraw Hill)
4. Advanced modern engineering mathemtics by Glyn james (pearson education)

BBS-151: Chemistry Lab

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

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.

BBS-152: Office Automation Lab

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

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

FIRST YEAR- 2nd Semester

BBS-201: Chemistry-II

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

Unit 1:
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 2:
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 3:
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 4:
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 5:
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"
5. Arun Bahl , B. S. Bahl and G. D. Tuli "Essential of Physical Chemistry"

BBS-202: Biochemistry

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

Unit 1:

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

Unit 2:

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 3:

Structures, properties and classification, carbohydrates as a source of energy ,Metabolism of carbohydrate-Glycolysis , TCA cycle, Electron transport system, Gluconeogenesis. [8]

Unit 4:

Structure, properties, classification and functions of lipids, Metabolism of fatty acids-fatty acid synthesis, beta oxidation of fatty acids (saturated). [8]

Unit 5:

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

Recommended Text/Reference Books:

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 T P **Credit: 4**
3 1 0

Unit-1:
The Cell**:** Prokaryotic and Eukaryotic cell, Cell theory, detailed account on prokaryotic & eukaryotic cell. Differences between animal and plant cell.[8]

UNIT-2:
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-3:
Biological membranes- Physicochemical properties of cell membranes and their structural constitution. Transport of nutrients across the membranes –simple, passive, facilitated diffusion.[8]

UNIT-4:
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-5:
Cellular Basis of differentiation and development – cell division, gametogenesis and fertilization, embryonic development in Drosophilla.[8]

Recommended Text/Reference Books:

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
3. Cell and Molecular Biology, (3rd Edition) – G. Karp, **Pub**: Johnwiley & Sons, Inc. NY
4. Molecular Biology of the Gene (5th Edtion), – J.D. Wastson, T.A. Baker, S.P. Bell, A. Gann, M. Levine, R. Losick, **Pub:** Pearson Education (Singapore) Pvt. Ltd. Delhi
5. Molecular Cell Biology, (5th Edition) H. Lodish, A. Berk P. Matsudaira Chris A. Kaiser, M.Krieger. M. P. Scott, L. Zipursky, J. Darnell. **Pub:** W.H. Freeman & Com., NY.
6. Cell and Molecular Biology (8th Edition) – DeRobertis & DeRoberties, **Pub:** B.I. Publishers Pvt Ltd. N. Delhi
7. Cell Biology – D.E. Sadava, **Pub**: Jones & Berlett Publishers
8. Cell Biology – T.D. Pollard & W.C. Earnshaw, **Pub**: Saunders an Imprint of Elsevier Science NY.

BBS-204: Microbiology

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

UNIT 1:
Introduction to Microbiology: History, scope and development of Microbiology; Applications of Microbiology in human welfare. Development of Microbiology in India: Antony van Leeuwenhoek, Alexander Fleming, Edward Jenner, Louis Pasteur, Robert Koch, Selman Waksman, Joseph Lister, A M Chakrrobarti etc. [8]

UNIT 2:
Culture techniques, Physical and chemical methods of sterilization. Diversity of Microbial World: Classification, general characteristics and structure of Bacteria-(eubacteria & archaebacteria), Cyanobacteria, Actinomycetes, Mycoplasma. [8]

UNIT 3:
Diversity of Microbial World: Classification, general characteristics, structure with emphasis on Mucor, Rhizopus, Puccinia, Cercospora, Aspergillus, Penicillium Alternaria, function of each part & components of cell. Reproduction & economic importance of Fungi. [8]

UNIT 4:
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 5:
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. [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.
5. A Textbook of Fungi- Vashistha (2003) S. Chand and Company Ltd.
6. Davis and Harper, General Microbiology

BBS-205: Biophysical tools & techniques

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

Unit 1:
Microscopy(Principal and application),Light microscopy, Phase contrast microscopy, florescence and electron microscopy (TEM and SEM). [8]

Unit 2:
Chromatography technique: Paper chromatography, thin layer chromatography, column chromatography, gas chromatography, affinity chromatography, ion exchange chromatography, gel filtration. [8]

Unit 3:
Electrophoresis: SDS-polyacrylamide gel electrophoresis, agarose gel electrophoresis, immunoelectrophoresis, isoelectric focusing. [8]

Unit 4:
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 5:
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

BBS-251:Cell Biology Lab

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

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.

BBS-252: Microbiology Lab

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

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 : Dr. Ajay Kumar
Date :

Internal Members
Signature: 1……. 2……
Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao
Date:

External Members
Signature: 1…… 2……
Name: Prof. (Dr.). Dr.
Date:

SECOND YEAR- 3rd Semester
BBS-301: Enzymology

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

Unit 1:
Historical perspective, Enzyme Classification. Isolation and Purification of Enzymes, , General Properties, Enzyme Activity , Specific Activity and Turnover Number. [8]

Unit 2:
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. [8]

Unit 3:
Mechanism of Enzyme action: enzyme-substrate complementarity, Interaction between enzyme and substrate- lock and key model, induced fit model. Factors associated with catalytic efficiency., Allosteric enzymes, Proenzymes-Zymogens and activation. [8]

Unit 4:
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- Overview of applications of immobilized enzyme systems. [8]

Unit 5:
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

Unit-1:
Plant and water relationship. 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. [8]

Unit-2:
Photosynthesis and Chemosynthesis: photosynthetic pigments, O2 evolution, photophosphorylation, CO_2 fixation - C_3- C_4 and CAM plants. [8]

Unit-3:
Respiration : aerobic and anaerobic respiration, respiratory pathways glycolysis, krebs 'cycle, electron transport, oxidative phosphorylation, pentose phosphate pathway, photorespiration, cyanide resistant respiration. [8]

Unit-4:
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. [8]

Unit-5:
Nitrogen metabolism: atmospheric nitrogen fixation, *nif*-gene & its role, nitrogen cycle, nitrogen assimilation, [8]

Recommended Text/Reference Books

1. Plant Physiology Taiz and Zeiger
2. Plant Physiology Salisbury and Ross
3. Plant Physiology By V. Verma

BBS-303: Animal Physiology

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

Unit1:
Digestive system Digestion: Introduction & component of Human digestive system, digestive enzymes, process of digestion, digestion of protein, carbohydrate and lipid [8]

Unit2:
Circulatory & Excretory system Blood: Composition and functions, Blood groups, Rh factor and their significance, blood clotting mechanism, anemia, heart,. Structure of kidney, types of nephron, mechanism of urine formation and its elimination and arginine, ornithin cycle. [8]

Unit3:
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 [8]

Unit4:
Nervous system & Muscle contraction Histology of nervous tissue, classification of neuron, neuroglia, myelation, structural organization of CNS. Muscle: Structure of various types of muscles and mechanism of muscle contraction [8]

Unit5:
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. [8]

Recommended Text/Reference Books:

1. Guyton and Guyton
2. Textbook of medical physiology by Guyton and Hall

BBS-304: Genetics

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

Unit 1:

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, lethal alleles. [8]

Unit 2:
Interaction of genes; epistasis, dominant and recessive gene interaction, genetic linkage. Sex chromosomes and sex determination; sex chromosomes, chromosomal Basis of sex determination, non chromosomal Basis of sex determination, sex linked inheritance. [8]

Unit 3:
Linkage and Crossing Over: Coupling and repulsion hypothesis, Linkage in maize and Drosophilea, Mechanism of crossing over and its importance. [8]

Unit 4:
Chromosomal Variations A General account of structural and numerical aberrations, 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). [8]

Unit 5:
Mutations: spontaneous and induced, Mutagens: Physical and chemical. Mutations in plants, animals, and microbes for economic benefit of man. [8]

Recommended Text/Reference Books:

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)
5. Genetics- Strickberger, 2 nd.
6. Microbial Genetics – D. Frifielder.
7. Advance Genetics by G.S. Miglani, Narosa Publishing House.
8. 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

Unit-I:
Introduction, history & importance of Plant tissue culture techniques. Principles of Plant Tissue Culture. Concepts of totipotency, competency, determinism, explants, inoculums. Requirements for a Plant Tissue Culture lab. [8]

Unit-II:
Nutrient media: Composition of commonly used nutrient culture media with respect to their contents like inorganic chemicals, organic constituents, vitamins, amino acids, Unidentified supplements, carbohydrate for energy source, phytohormones, complex substances, Activate charcoal etc. Hormones: Auxins, cytokinins, Gibberellins, Abscisic Acid, ethylene. Surface sterilization. Basic procedure for Aseptic Tissue transfer. Sterilisation of the media. Inculation of culture. [8]

Unit-III :
Culture of plant materials- explants selection and technique of culturing the same. Growth conditions. Harvesting and Growth Measurements, organogenesis, Embryogenesis, Somaclonol variation, Androgenesis and Gynogenesis, protoplast culture. Callus and cell culture,. Methods of sub culturing and transfer of regenerated plants to the field. [8]

Unit-IV:
Micro propagation: Proliferation of axillary buds, induction of adventitious buds and bulbs, callus regeneration, continuous culture, immobilized cultures, estimation of growth and artificial seeds. [8]

Unit-V :
Cloning: Isolation of single cells, culturing of single cell- different methods, culture cell viability test. Cryopreservation and slow growth cultures, Freezing and storage, thawing, reculture. Application of plant tissue culture in transgenic plants and production of secondary metabolites and industrial products. [8]

Recommended Text/Reference Books:

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 Cell Culture, Advances in Biochemical Engineering and Biotechnology. Anderson, L.A.,
5. Recombinant DNA. Watson, 1992.
6. Gene transfer to Plants. Portykns, 1995.
7. Plant Biotechnology. Mantell and Smith, 1984.
8. Genetic Engineering of Plants. Kosuge, 1983.
9. Biochemistry & Molecular Biology of Plants. Kosuge. 1983

BBS-351: Enzymology Lab

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

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

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

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.

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

Internal Members

Signature:	1…….	2……
Name:	Mr. Ajit Pratap Singh Yadav	Mr. Vachaspati Rao
Date:		

External Members

Signature:	1……	2……
Name:	Prof. (Dr.).	Dr.
Date:		

SECOND YEAR- 4th Semester

BBS-401: Molecular Biology

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

Unit- 1:
DNA as the genetic material : Griffiths and Hershey-Chase experiment, Central Dogma of molecular biology, structure of A, B and Z-DNA, structure of RNA (t-RNA, m-RNA and r-RNA), DNA denaturation and renaturation. [8]

Unit -2:
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. [8]

Unit- 3:
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. [8]

Unit -4:
Genetic code, wobble hypothesis, Translation: (Eukaryotic & prokaryotic), translation machinery, mechanisms of initiation ,elongation and termination.[8]

Unit -5:
Regulation of gene expression in prokaryotes. The operon concept. The lac operons, Mutations: Spontaneous and induced; chemical and physical mutagens. DNA damage. [8]

Recommended Text/Reference Books:

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

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

UNIT 1:
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. Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium, role of carbon di oxide, serum and supplements. [8]

UNIT 2:
Characteristics of cells in culture: Contact inhibition, anchorage dependence, cell-cell communication ,Cell senescence; cell and tissue response to trophic factors. Primary Culture: Behavior of cells, properties, utility. Explant culture; suspension culture. Definition of cell lines, maintenance and management. [8]

UNIT 3:
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. [8]

UNIT 4:
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. [8]

UNIT 5:
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. [8]

Recommended Text/Reference Books:

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

BBS-403: Biostatistics

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

Unit 1:
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). [8]

Unit 2:
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. [8]

Unit-:3
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. [8]

Unit-4:
Test of Hypothesis, Test of significance, chi-square test, t-test, F-test and ANOVA (Analysis of variance) One way and two way classification. [8]

Unit-5: 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. [8]

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

UNIT-1:
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. [8]

UNIT-2:
Principles of DNA sequencing (chemical chain termination, Dideoxy chain termination method, Automatic sequencer). RNA sequencing. Protein sequencing (Edmand degradation method). [8]

UNIT-3:
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). [8]

UNIT-4:
Protein structure prediction (Chou Fasman method) : Secondary and tertiary structures. Homology Modelling, ORF prediction, Gene prediction, Micro array data analysis. Profiles and motifs. [8]

UNIT-5:
Structure visualization methods (RASMOL, CHIME etc.). Protein Structure alignment and analysis. Application of Bioinformatics in drug discovery and drug designing. [8]

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)
5. Instant notes in Bioinformatics by Westhead, parish and Tweman (Bios scientific publishers)

BBS-405: Ethics, Patenting and Bio-Entrepreneurship

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

UNIT 1:
Risk analysis: risk assessment, risk management, risk monitoring, risk communication.
Containment: Biological containment, Physical containment
Biosaftey levels: Good laboratory practices.
Risk management in field trials: physical strategies for confinement , Biological strategies for confinement. [8]

UNIT 2:
National biosafety regulatory framework in India: Recombinant DNA advisory committee, institutional biosafety committee, Review committee on genetic manipulation, Genetic engineering approval committee, State biotechnology formation committee, District level committee
Recombinant DNA safety guidelines, revised guidelines for research in transgenic plants, Cross border movement of transgenic germplasm for research purposes.
Biosafety concerns: risk to human health, risk of toxicity, risk of allergies, antibiotic resistance. [8]

UNIT3:
Protection of intellectual property , World organization , Forms of protection: copy right, trade mark.
Patent: patent application , International patenting and patent cooperation treaty, Uses of technical information in patent document, Revocation of patent. Patenting of biological material(microorganism, plant patent, animal patent.) [8]

UNIT 4:
Patenting procedure in India, Geographical indication, Trade secret, Design, Layout design of integrated circuits. [8]

UNIT 5:
Plant breeders rights: UPOV, functions of UPOV: Breeder exemption , Farmers privilege Plant variety protection in India : Farmers rights ,Advantages & disadvantages of PBR. [8]

Recommended Text/Reference Books

1. Innovation and Entrepreneurship in Biotechnology, An International Perspective Damian Hine,John Kapeleris Edward Elgar Publishing Limited Northampton Massachusetts USA

BBS-451: Molecular Biology Lab.

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

1. Estimation of DNA content in the given sample by diphenylamine method.
(Nitrogen cylinders, -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.)

BBS-453: Bioinformatics Lab

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

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 : Dr. Ajay Kumar
Date :

Internal Members

Signature:	1…….	2……
Name:	Mr. Ajit Pratap Singh Yadav	Mr. Vachaspati Rao
Date:		

External Members

Signature:	1……	2……
Name:	Prof. (Dr.).	Dr.
Date:		

Third Year -5th Semester

BBS-501: Genetic Engineering

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

UNIT-1:
Molecular tools and their application: Nucelic Acid purifications, amplification, yield analysis and applications. Enzyme used recombinant DNA technology,Nucleic Acid sequencing. Gene Cloning vectors, plasmids, bacteriophages, cosmids, phagemids, Ti plasmid, artificial chromosomes. Expression vectors. [8]

UNIT-2:

Principles & steps involved in gene cloning, linkers, adaptors and their chemical synthesis; Construction of cDNA & library genomic libraries , Screening of libraries for selection of desired clones using nucleic acid hybridization techniques, Southern blotting, Dot and slot blot. [8]

UNIT-3:

Techniques for studying gene expression: Microarray, Northern and Western blot, DNA footprinting, primer extension, Rnase protection, Reporter assays techniques of in vitro mutagenesis and protein engineering. [8]

UNIT-4:
Polymerase chain reaction: Principles, variations and applications. Microarray, DNA primers, Primer designing, Nick translation, Genome analysis for global patterns of gene expression using fluorescent – labelled cDNA or end labelled RNA probes. Analysis of single nucleotide polymorphism using DNA chips. [8]

UNIT-5:
Strategies of gene delivery, gene silencing. Gene delivery in plants by *Agrobacterium tumefaciens.* Gene therapy and its application. [8]

Recommended Text/Reference Books:

1. G.R. Glick & J.J. Pasternak: Molecular Biotechnology
2. Watson, Hopkin, Roberts et al.: Molecular Biology of the Gene, 4th ed.
3. T.A. Brown – Gene Cloning.
4. Microbial Genetics – D. Frifielder.
5. Baltimore- Molecular Biology of the Cell.
6. Benjamin Levin – Genes VIII, 8th ed.
7. R.Williamson – Genetic Engineering.

BBS-502: Environmental Science

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

Unit -1:
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 -2:
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 -3:
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 -4:
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. [8]

Unit -5:
Global warming, acid rains, depletion of ozone layer population growth the population explosion, family welfare |Program, human rights, Biofertilizers, Biopesticides vermicomposting. [8]

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

UNIT-1:
History & phylogeny of Immune system. Types of immunity. Cells & organs of the immune system. Structure and function of immunologlobins. Nature of antigens, antigenicity and immunogenecity. Lymphocyte traffic. [8]

UNIT-2:
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. [8]

UNIT-3:
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. [8]

UNIT-4:
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. [8]

UNIT-5:
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.[8]

Recommended Text/Reference 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**
0 0 2

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

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.

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

Internal Members

Signature:	1…….	2……
Name:	Mr. Ajit Pratap Singh Yadav	Mr. Vachaspati Rao
Date:		

External Members

Signature:	1……	2……
Name:	Prof. (Dr.).	Dr.
Date:		

THIRD YEAR- 6th Semester

BBS-601: Industrial Biotechnology

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

Unit-1:
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. [8]

Unit-2:
Improvement of Industrial Strains: mutation, genetic engineering techniques, preservation of cultures-storage on agar slants, soil culture, lyophilization, storage in liquid nitrogen. [8]

Unit-3:
Fermentation: Brief introduction, Types of fermenter-aerated and agitated fermenter, Basic function of Baffle, Impeller and Sparger. [8]

Unit-4:
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. [8]

Unit-5:
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. [8]

Recommended Text/Reference 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

Unit 1:
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. Callus Culture Technique.[8]

Unit 2:
Suspension and Organ Culture Techniques: Introduction, Principle, Protocols, Types, Growth measurement and synchronization. Anther 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. [8]

Unit3:
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. [8]

Unit 4:
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.[8]

Unit 5:
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

Animal Tissue culture : J. Paul
Introduction to Plant Tissue culture : M.K. Razdan
Plant Tissue Culture : Theory & Practice : S.S. Bhojwani & M.K. Razdan
Micropropagation :Debergh& Zimmermann
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 : Dr. Ajay Kumar
Date :

Internal Members

Signature:	1…….	2……
Name:	Mr. Ajit Pratap Singh Yadav	Mr. Vachaspati Rao
Date:		

External Members

Signature:	1……	2……
Name:	Prof. (Dr.).	Dr.
Date:		