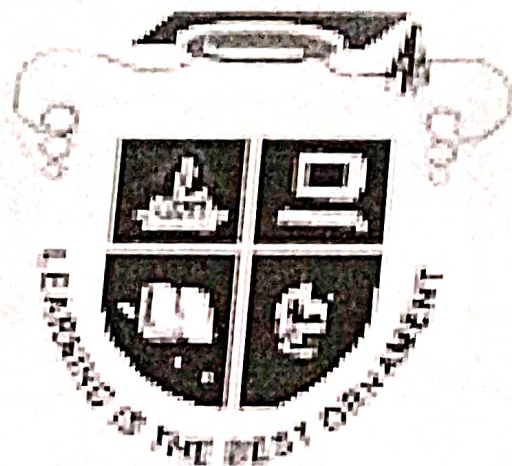


**GOVT. DEGREE COLLEGE FOR WOMEN  
BEGUMPET, HYDERABAD-16  
AUTONOMOUS**



**DEPARTMENT OF BIOTECHNOLOGY**

**CBCS SYLLABUS FOR THE YEAR 2021-22**

*Handwritten signature or mark*

## Annexure-1 Credits- for B.Sc. Life Sciences

Courses		Papers	Total Credits	Credits for each paper/Semester					
				B.Sc.					
				I	II	III	IV	V	VI
Core Courses DSC	Optional-1	4	20	5	5	5	5	-	-
	Optional-2	4	20	5	5	5	5	-	-
	Optional-3	4	20	5	5	5	5	-	-
Elective Courses DSE	Optional-1	2	10	-	-	-	-	5	5
	Optional-2	2	10	-	-	-	-	5	5
	Optional-3	2	10	-	-	-	-	5	5
Language	English (First Language)	5	20	4	4	3	3	3	3
	Second Language	5	20	4	4	3	3	3	3
Ability Enhancement Compulsory Course AECC	Environmental Science/Basic Computer Skills	1	2	2	-	-	-	-	-
	Basic Computer Skills/Environmental Science	1	2	-	2	-	-	-	-
Skill Enhancement Course SEC	SEC1	1	2	-	-	2	-	-	-
	SEC2	1	2	-	-	2	-	-	-
	SEC3	1	2	-	-	-	2	-	-
	SEC4	1	2	-	-	-	2	-	-
Generic Elective GE	Open Stream	1	4	-	-	-	-	4	-
Project Work/Optionals		1	4	-	-	-	-	-	4
Total Credits in each semester				25	25	25	25	25	25
Total Credits in UG				150					
Credits under Non-CGPA		NSS/NCC /sports/ Extracurricular	6	Upto 6 (2 in each year)					
		Summer Internship	4	Upto 4 (2 in each, after I & II years)					

### Annexure II Proposed New Grading System

SGPA (SEMESTER GRADE POINT AVERAGE)			
S.No.	Grade Point	Range of marks	Grade Letter
1	10	Equal to and above 90 Marks	A+
2	9	More than or equal to 80 and less than 90 Marks	A
3	8	More than or equal to 70 and less than 80 Marks	B+
4	7	More than or equal to 60 and less than 70 Marks	B
5	6	More than or equal to 55 and less than 60 Marks	C+
6	5	More than or equal to 50 and less than 55 Marks	C
7	4	More than or equal to 40 and less than 50 Marks	D
8	0	Below 40 Marks	F

*Mahesh*

*Rohini*

*Ramesh*

*P. Atkar*



GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.  
AUTONOMOUS (CBCS)

PROPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM FOR B.SC.  
BIOTECHNOLOGY COURSE

FIRST YEAR- SEMESTER I				
CODE	COURSE TITLE	COURSE TYPE	H PW	CREDITS
BS 101	Environmental Science/Basic Computer Skills	AECC-1	2	
BS 102	English	CC-1A	4	4
BS 103	Second language	CC-2A	4	4
BS 104	Optional I- Cell biology and Genetics	DSC-1A	4T+3P=7	4+1=5
BS 105	Optional II	DSC-2A		4+1=5
BS 106	Optional III	DSC-3A		4+1=5
TOTAL				25
FIRST YEAR- SEMESTER II				
BS 201	Gender Sensitization / Computer skills	AECC-2	2	2
BS 202	English	CC-1B	4	4
BS 203	Second language	CC-2B	4	4
BS 204	Optional I- Biological Chemistry and Microbiology	DSC-1B	4T+3P=7	4+1=5
BS 205	Optional II	DSC-2B		4+1=5
BS 206	Optional III	DSC-3B		4+1=5
TOTAL				25
SECOND YEAR- SEMESTER III				
BS 301	SEC 1: UGC specified SEC	SEC-1		
BS 302	SEC 2: Immunological techniques ✓	SEC-2	2	2
BS 303	English	CC-1C	3	3
BS 304	Second language	CC-2C	3	3
BS 305	Optional I- Molecular Biology and Recombinant DNA Technology	DSC-1C	4T+3P=7	4+1=5
BS 306	Optional II	DSC-2C		4+1=5
BS 307	Optional III	DSC-3C		4+1=5
TOTAL				25
SECOND YEAR- SEMESTER IV				
BS 401	SEC 3: UGC specified SEC	SEC-3		
BS 402	SEC 4: Molecular markers in plant breeding	SEC-4	2	2
BS 403	English	CC-1D	3	3
BS 404	Second language	CC-2D	3	3
BS 405	Optional I- Bioinformatics and Biostatistics	DSC-1D	4T+3P=7	4+1=5
BS 406	Optional II	DSC-2D		4+1=5
BS 407	Optional III	DSC-3D		4+1=5
TOTAL				25

Mahesh

Rohini

Dr. S. S. S.

P. H. K.



GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.  
AUTONOMOUS (CBCS)

PROPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM FOR B.SC.  
BIOTECHNOLOGY COURSE

FIRST YEAR- SEMESTER I				
CODE	COURSE TITLE	COURSE TYPE	II PW	CREDITS
BS 101	Environmental Science/Basic Computer Skills	AECC-1	2	
BS 102	English	CC-1A	4	4
BS 103	Second language	CC-2A	4	4
BS 104	Optional I- Cell biology and Genetics	DSC-1A	4T+3P=7	4+1=5
BS 105	Optional II	DSC-2A		4+1=5
BS 106	Optional III	DSC-3A		4+1=5
	<b>TOTAL</b>			<b>25</b>
FIRST YEAR- SEMESTER II				
BS 201	Gender Sensitization / <i>Computer skills</i>	AECC-2	2	2
BS 202	English	CC-1B	4	4
BS 203	Second language	CC-2B	4	4
BS 204	Optional I- Biological Chemistry and Microbiology	DSC-1B	4T+3P=7	4+1=5
BS 205	Optional II	DSC-2B		4+1=5
BS 206	Optional III	DSC-3B		4+1=5
	<b>TOTAL</b>			<b>25</b>
SECOND YEAR- SEMESTER III				
BS 301	SEC 1: UGC specified SEC	SEC-1		
BS 302	SEC 2: Immunological techniques ✓	SEC-2	2	2
BS 303	English	CC-1C	3	3
BS 304	Second language	CC-2C	3	3
BS 305	Optional I- Molecular Biology and Recombinant DNA Technology	DSC-1C	4T+3P=7	4+1=5
BS 306	Optional II	DSC-2C		4+1=5
BS 307	Optional III	DSC-3C		4+1=5
	<b>TOTAL</b>			<b>25</b>
SECOND YEAR- SEMESTER IV				
BS 401	SEC 3: UGC specified SEC	SEC-3		
BS 402	SEC 4: Molecular markers in plant breeding	SEC-4	2	2
BS 403	English	CC-1D	3	3
BS 404	Second language	CC-2D	3	3
BS 405	Optional I- Bioinformatics and Biostatistics	DSC-1D	4T+3P=7	4+1=5
BS 406	Optional II	DSC-2D		4+1=5
BS 407	Optional III	DSC-3D		4+1=5
	<b>TOTAL</b>			<b>25</b>

Mahesh

Rohini

Dr. Sanyal

P. Alkar



**THIRD YEAR- SEMESTER V**

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
BS 501	English	CC-1E	6	3
BS 502	Second language	CC-2E	3	3
BS 503	Basics in Biotechnology	GE	4	4
BS 504	Optional I- A/B (A) Plant Biotechnology or (B) Medical Biotechnology	DSE -1E	4T+3P=7	4+1=5
BS 505	Optional- II A/B	DSE -2E		4+1=5
BS 506	Optional- III A/B	DSE -3E		4+1=5
	<b>TOTAL</b>			<b>25</b>

**THIRD YEAR- SEMESTER VI**

BS 601	Project in Biotechnology/ Optional I: (IPR, Biosafety and Entrepreneurship)	Project work/Opt.P	4	4
BS 602	English	CC-1F	3	3
BS 603	Second language	CC-2F	3	3
BS 604	Optional II- A/B (A) Animal Biotechnology or (B) Environmental Biotechnology ..	DSE-1F	4T+3P=7	4+1=5
BS 605	Optional- II A/B	DSE -2F		4+1=5
BS 606	Optional- III A/B	DSE -3F		4+1=5
	<b>TOTAL</b>			<b>25</b>
	<b>TOTAL Credits</b>			<b>150</b>

Total credits= 164-12 (AECC 4 + SEC 8) =15

AECC: Ability Enhancement Compulsory Course

SEC: Skill Enhancement Course

SEC\*:SEC(UGC Recommended Courses)

DSC: Discipline Specific Course

DSE: Discipline Specific Elective

GE: Generic Elective

Previously recommended SEC I :Enzyme Technology\* and SEC 4: Intellectual Property Rights\* have been changed to two UGC recommended SEC courses. SEC 1: Industrial Fermentation\* and SEC 4:

Drug designing\*

*Maheesh*





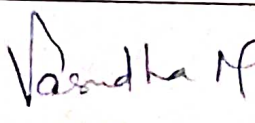
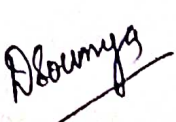
*Rohini*

*Shammy*

*P. Alkur*

GOVERNMENT COLLEGE FOR WOMEN  
BEGUMPET, HYDERABAD – 500016  
(AUTONOMOUS)

Constitution of Board of Studies - 2018-2021

S.No	Name		Signature
01.	V.Rohini, Assistant professor of Biotechnology.	Chairman BOS, GDC(w) Begumpet	
02.	Dr. Smita C. Pawar Head, Department of Genetics, Osmania university	Chairperson BOS, University Nominee, Osmania University	ABSENT
03.	Dr. A.Uma Associate Professor, BOS chair- Centre for Biotechnology, Officer - Incharge Examination, Institute of Science and Technology, JNTUH	Subject Expert Nominated by Academic Council	
04.	Dr. Anil Pasupulati Assistant Professor, Department of Biochemistry, School of Life Sciences, University of Hyderabad	Subject Expert Nominated by Academic Council	
05	Mr. Mahesh Kyasani, Sr Manager, Manufacturing Sciences, Biological E Limited, Shameerpet	Representative from Industry	
06	Dr. M. Vasudha, Assistant Professor of Genetics, Government Degree College for Women, Begumpet, Hyderabad.	Member	
07	D. Soumya, M.Sc. Biotechnology, University college Science, Saifabad Hyderabad	Alumnus	



Government Degree College for Women, Begumpet.  
Hyderabad. Autonomous(CBCS)

Agenda for the Board of Studies Meeting (2021-22)

1. Approval of the Syllabus for V and VI Semesters of the B.Sc., III year according to CBCS.
2. Review of the Syllabus and Model papers.
3. Preparation of Panel of Examiners and their approval
4. Review and suggestions on Methodologies for innovative teaching and evaluation techniques and extension activities.
5. Reapproval of the syllabus for I and II semesters of B.Sc., I Year according to CBCS.
6. Approval of scheme of evaluation ( 60 marks for the External examination and 40 marks for the Internal examination)

Division of 40 marks is as follows.

1. 20marks internal assessment in the form of descriptive exam, where two internals will be conducted and average of two is considered.
2. Unit wise test in the form of 20 objective questions, half mark each and a total value of 10 marks.
3. 5marks for Seminar/Quiz / group discussion and 5 marks for assignments.

*Mahesh*

*Rohini*

*Deviya*

*AD*

*P. H. Kumar*

**Government Degree College for Women, Begumpet.  
Hyderabad. Autonomous(CBCS)**

**Board of Studies Meeting (2021-22)**

Keeping in view of the CBCS Pattern, rearrangement of B.Sc. III yr syllabus was discussed at length for the approval with the members of BOS Committee.

The ratification of the existing pattern of marks distribution of B.Sc. III yr Semester-V&VI Biotechnology syllabus has been approved by the members in the BOS Committee.

Marks distribution for Semester-V & VI is

Theory-Internal Assessment- 40 Marks

- (2 Internals-20+20, Average of the two internals will be taken)+5M Assignment (write up of 4-5 pages)+ 5M Seminar+10 M MCQS(Average of 4 MCQS Tests)
- External Examination -60 Marks

Total: 100 Marks

- Practical External Examination: 50 Marks
- SEMESTER –V, Title of the Paper-V (DSE-I) is” PLANT BIOTECHNOLOGY” (Theory& Practical)
- Paper V (GE-I) BASICS OF BIOTECHNOLOGY- (Theory)
- SEMESTER –VI, Title of the Paper-VI (DSE-II) is “ANIMAL BIOTECHNOLOGY” (Theory& Practical)
- PROJECT- 100 Marks (-4 credits)

  
P. Sultana









**GOVERNMENT DEGREE COLLEGE FOR WOMEN (UG & PG)**  
**AUTONOMOUS (CBCS)**  
**BEGUMPET, HYDERABAD-500016**  
**DEPARTMENT OF BIOTECHNOLOGY.**

The Panel of Examiners nominated and approved by the Board of Studies members for the Semesters Examination of Biotechnology has been enlisted below.

S.No	Name	Designation	Address
1	Dr. H.Surekha Rani, Mobile : 9866620067	Assistant Professor of Biotechnology	Department of Genetics and Biotechnology Osmania University
2	Dr. A.Uma Mobile: 9848120819 Vedavathi1@jntuh.ac.in	Associate Professor of Biotechnology BOS chair-	Centre for Biotechnology, IST - JNTUH
3.	Dr.Anil Pasupulati anilkumar@uohyd.ac.in	Assistant Professor, Department of Biochemistry	School of Life Sciences, University of Hyderabad
4	Dr. Y. Venkateswarlu Mobile: 8801150220	Asst. Professor of Biotechnology	Govt. Degree college, Khairatabad ,Hyderabad
5	Dr. P. Suresh Kumar Mobile: 9701407475	Head ,Asst. Professor of Biotechnology	Loyola Academy Degree and P.G College, Hyderabad
6	Ms. D.Annapurna Mobile 9959220195	Asst. Professor of Biotechnology	Tara GDC,Sanga Reddy
7.	Mrs. P. Pushpalatha Mobile: 8099872878	Head ,Asst. Professor of Biotechnology	Govt. City college, Hyderabad.
8	Ms.D.Kethora	Asst. Professor of Biotechnology	St.Ann's Degree College for Women, Mehdipatnam, Hyd
9	Dr.D.Sambhasiva	Assistant Professor of Biotechnology	NizamCollege,Hyderabad

GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.

AUTONOMOUS(CBCS)

B. Sc. 1 Year (2020-21)

MODEL QUESTION PAPER

Subject: Biotechnology

Time: 2 hrs

Max Marks:60

Min marks: 24

SECTION-A

I Write any 5 Short Answer Type Question

5×4=20M

(2 from each unit)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

SECTION-B

II Essay Type Questions (Internal Choice)

4×10=40M

1. UNIT I : A (or) B
2. UNIT II : A (or) B
3. UNIT III : A (or) B
4. UNIT IV : A (or) B

*Pohri*

*P. Adhikari*

*P. Adhikari*

*Mahesh*



GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.  
AUTONOMOUS (CBCS)

B. Sc. (2021-22)

INTERNAL ASSESSMENT ~~MODEL~~ QUESTION PAPER

Subject: Biotechnology

Max.MARKS:20

I. Answer any two questions (short answer type)

2x5=10M

- 1.
- 2.
- 3.
- 4.

II. Answer any one question ( essay answer type)

1x10=10M

- 1.
- 2.

Pohini

AD  
P. H. Kumar

Alamy

Mahesh

**GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.**

**AUTONOMOUS (CBCS)**

**PROGRAM OUTCOMES**

**PO 1 Domain Expertise:**

- Acquire comprehensive knowledge and skills.
- Make use of the knowledge in an innovative manner.
- Effectively apply the knowledge and skills to address various issues.

**PO 2 Modern equipment Usage**

- Use ICT effectively.
- Access, retrieve and use authenticated information.
- Access, retrieve and use authenticated information. Have knowledge of software applications to analyze data.

**PO 3 Computing Skills and Ethics**

- Develop rationale and scientific thinking process.
- Use technology intelligently for communication, entertainment and for the benefit of mankind.
- Ensure ethical practices throughout ones endeavors for the wellbeing of human race.

**PO 4 Complex problem Investigation & Solving**

- Predict and analyze problems.
- Frame hypotheses.
- Investigate and interpret empirical data.
- Plan and execute action.

*Mahesh*

*Rohit*

*Alamy*

*P. H. Kim*

*P. H. Kim*



### **PO 5 Perform effectively as Individuals and in Teams**

- Work efficiently as an individual
- Cooperate, coordinate and perform effectively in diverse teams/groups.
- Prioritize common interest to individual interest.

### **PO 6 Efficient Communication & Life Skills**

- Express thoughts in an effective manner
- Listen, understand and project views in a convincing manner.
- Decide appropriate media to share information
- Develop skills to present significant information clearly and concisely to interested groups.

### **PO 7 Environmental Sustainability**

- Understand sensibly the Environmental challenges.
- Think critically on environment sustainability measures.
- Propagate and follow environment friendly practices.

### **PO 8 Societal contribution**

- Render service for the general good of the society.
- Involve voluntarily in social development activities at Regional, National, global levels.
- Have own pride in volunteering to address societal issues viz: calamities, disasters, poverty, epidemics.
- Be a patriotic citizen to uphold the values of the nation

### **PO 9 Effective Project Management**

- Identify the goals, objectives and components of a project and decide the appropriate time of completion.
- Plan, organize and direct the endeavors of teams to achieve the set targets in time.
- Be competent in identifying opportunities and develop strategies for contingencies.

*Mallesh*

*Rohit*

*DSamys*

*P. Alkan*

## Programme Specific Outcomes of B. Sc. in Biotechnology

1. Apply the knowledge of various branches of Biotechnology to solve the complex problems.
2. Identify, formulate, research literature, and analyze problems to arrive at substantiated conclusions in natural sciences.
3. Design solutions for the public health and safety, and the cultural, societal, and environmental considerations.
4. Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Mahesh

Bahini

Doumya

AD

r. Al Kier



GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.  
AUTONOMOUS (CBCS)  
B.Sc. Biotechnology 1 YEAR (2021-22)  
SEMESTER- I DSC-Paper- I: CELL BIOLOGY AND GENETICS

COURSE OUTCOMES

CREDITS-4 TEACHING HOUR/WEEK-4

After completion of the course student will be able to:

- Recall the history of cytology and distinguish between Prokaryotic and Eukaryotic cell
- Explain the organization of Genes and chromosomes, chromosome morphology and its aberrations
- Compare and contrast the events of cell cycle and its regulation.
- The student will demonstrate proficiency in understanding the basic structure of cell and interpret the inheritance of characters by using linkage and crossing over.

**Unit 1: Cell structure and Functions**

- 1.1. Cell as basic unit of living organisms-bacterial, fungal, plant and animal cells
- 1.2. Ultrastructure of prokaryotic cell (cell membrane and plasmids, Nucleoid)
- 1.3. Ultrastructure of eukaryotic cell (cell wall, cell membrane, nucleus, mitochondria, chloroplast, endoplasmic reticulum, Golgi apparatus, vacuoles)
- 1.4. Fluid mosaic model, Sandwich model, Cell membrane permeability
- 1.5. Structure of chromosome-morphology, components of chromosomes (histones and nonhistones),
- 1.6. Specialized chromosomes (Polytene, Lampbrush) Structural and Numerical Aberrations

*Seminar*

**Unit 2: Cell cycle**

- 2.1 Bacterial cell division
- 2.2 Eukaryotic cell cycle –phases
- 2.3 Mitosis - Stages -significance
- 2.4 Meiosis- Stages-significance
- 2.5 Senescence and necrosis
- 2.6 Apoptosis

**Unit 3: Principles and mechanism of inheritance**

- 3.1. Mendel's experiments - factors contributing to success of Mendel's experiments
- 3.2. Law of segregation - Monohybrid Ratio; Law of independent assortment- Dihybrid ratio, Trihybrid ratio
- 3.3. Deviation from Mendel's laws- partial or incomplete dominance (eg: Flower Color in *Mirabilis jalapa*), Co-dominance (eg: MN Blood groups), Non allelic interactions - types of epistasis, modification of dihybrid ratios(12:3:1; 9:7; 15:1; 9:3:4,9:7; 13:3)
- 3.4. Penetrance and Expressivity (eg: Polydactyly. Waardenburg syndrome). pleiotropism, phenocopy- microcephaly, cleft lip.
- 3.5. Multiple alleles (eg: Coat color in Rabbits, eye color in *Drosophila* and ABO Blood groups)

*Mahesh*

*Shiv*

*Dhanu*

*P. Atkin*

3.6. X-Y chromosomes - Sex determination in Drosophila, Man, X-linked inheritance - Hemophilia and Color blindness; X-inactivation.

#### Unit 4: Linkage, Recombination and Extension to Mendel's Laws

- 4.1. Linkage and recombination - Cytological proof of crossing over, phases of linkage, recombination frequency, gene mapping and map distance
- 4.2. Non-Mendelian Inheritance - Maternal effect (Shell coiling in snail), variegation in leaves of *Mirabilis jalapa*
- 4.3. Cytoplasmic male sterility in Maize.
- 4.4. Mitochondrial inheritance in human and poky in *Neurospora crassa*
- 4.5. Chloroplast inheritance in *Chlamydomonas*
- 4.6. Hardy-Weinberg Equilibrium.

#### OPTIONAL- I: PRACTICALS

##### CELL BIOLOGY AND GENETICS

1. Microscopic observation of cells: bacteria, fungi, plant and animal
2. Preparation of different stages of Mitosis (onion root tips)
3. Preparation of different stages of Meiosis (grasshopper testis)
4. Preparation of Polytene chromosome from *Drosophila* salivary gland
5. Monohybrid and dihybrid ratio in *Drosophila*
6. Monohybrid and dihybrid ratio in Maize
7. Problems on co-dominance, epistasis, two point and three point test cross, gene mapping.
8. Statistical applications of Hardy-Weinberg Equilibrium

##### Spotters:

1. Prokaryotic Cell (Bacteria)
2. Mitochondria
3. Chloroplast
4. Polytene Chromosomes
5. Test Cross
6. Blood Grouping
7. Hemophilia Pedigree
8. Crossing Over
9. Synaptonemal Complex
10. Nucleosome Model

##### REFERENCE BOOKS

1. Cell & Molecular Biology. E.D.D De Robertis & E.M.F De Robertis, Waverly publication
2. An introduction to Genetic Analysis by Anthony, J.F. J.A. Miller, D.T. Suzuki, R.C. Richard Lewontin, W.M-Gilbert, W.H. Freeman publication
3. Principles of Genetics by E.J. Gardner and D.P. Snusted. John Wiley & Sons, New York
4. The science of Genetics, by A.G. Atherly J.R. Girton, J.F. McDonald, Saundern College publication

M. Doshi

Robert

Debnay

R. H. Khan



5. Principles of Genetics by R.H. Tamarin McGrawhill
6. Theory & problems in Genetics by Stansfield, Schaum out line series McGrawhill
7. Molecular Cell Biology Lodish, H., Baltimore, D; fesk, A., Zipursky S.L., Matsudaride, P. and Darnel. American Scientific Books. W.H. Freeman, New York
8. The cell: A molecular approach. Geoffrey M Cooper, Robert E Hausman, ASM press
9. Cell and Molecular Biology, Concepts and Experiments — Gerald Karp, John Wiley & Sons, Inc.
10. Cell Biology And Genetics by P.K. GUPTA

*Robert*

*Downys*

*P*

*P. H. Kim*

*Mohesh*

GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.  
AUTONOMOUS (CBCS)  
BSC BIOTECHNOLOGY-I YEAR (2021-22)  
SEMESTER- II DSC-Paper- II: BIOLOGICAL CHEMISTRY AND MICROBIOLOGY

COURSE OUTCOMES

CREDITS-4 TEACHING

HOUR/WEEK-4

After completion of the course student will be get exposed

- To strong theoretical and practical background in fundamental concepts.
- To get insights of multiple important technical areas of Biochemistry.
- To apply contextual knowledge and modern tools of biochemical research for solving problems.
- To give students a generalized idea about microbiology <sup>and</sup> its basic aspects

### Unit 1: Biomolecules

- 1.1 Carbohydrates- importance, classification; structure and functions of monosaccharaides (glucose & fructose), disaccharides (sucrose, lactose & maltose) and polysaccharides (starch, glycogen & inulin)
- 1.2 Amino acids- importance, classification, structure, physical and chemical properties of amino acids; peptide bond formation
- 1.3 Proteins- importance, structure of proteins- primary, secondary, tertiary and quaternary
- 1.4 Lipids- importance, classification- simple lipids (triacylglycerides & waxes), complex lipids (phospholipids & glycolipids), derived lipids (steroids, terpenes & carotenoids)
- 1.5 Nucleic acids :structure and chemistry of DNA (Watson and crick) and RNA(TMV)  
Structure and forms of DNA (A, B and Z)
- 1.6 Enzymes- importance, classification and nomenclature; Michaelis-Menton Equation, factors influencing the enzyme reactions; enzyme inhibition (competitive, uncompetitive & mixed), co-enzymes

### Unit 2: Bioenergetics

- 2.1 Glycolysis, Tricarboxylic Acid (TCA) Cycle,
- 2.2 Electron Transport, Oxidative Phosphorylation
- 2.3 Gluconeogenesis and its significance
- 2.4 Transamination and Oxidative deamination reactions of amino acids
- 2.5 B-Oxidation of Fatty acids
- 2.6 Glyoxalate cycle

### 3. Unit: Fundamentals of Microbiology

- 3.1 Historical development of microbiology and contributors of microbiology



- 3.2 Microscopy: Bright field microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescent microscopy, Scanning and Transmission electron microscopy
- 3.3 Outlines of classification of microorganisms
- 3.4 Structure and general characteristics of bacteria and virus
- 3.5 Disease causing pathogens and symptoms (Eg: Mycobacterium, Hepatitis)
- 3.6 Structure and general characteristics of micro-algae and fungi

#### **4. Unit: Culture and identification of microorganisms**

- 4.1 Methods of sterilization- physical and chemical methods
- 4.2 Bacterial nutrition nutritional types of bacteria, essential macro & micro nutrients and growth
- 4.3 Bacterial growth curve-batch and continuous cultures, synchronous cultures measurement of bacterial growth-measurement of cell number and cell mass.
- 4.4 Factors affecting bacterial growth
- 4.5 Culturing of anaerobic bacteria and viruses
- 4.6 Pure cultures and its characteristics

#### **OPTIONAL I: PRACTICALS**

##### **BIOLOGICAL CHEMISTRY AND MICROBIOLOGY**

- 1. Preparation of normal, molar & molal solutions.
- 2. Preparation of buffers (acidic, basic & neutral)
- 3. Qualitative tests of sugars, amino acids & lipids
- 4. Estimation of total sugars by anthrone method
- 5. Separation of amino acids by paper chromatography
- 6. Estimation of proteins by biuret method
- 7. Sterilization methods
- 8. Preparation of microbiological media (bacterial, algal & fungal)
- 9. Isolation of bacteria by streak, spread and pour plate methods
- 10. Isolation of bacteria from soil
- 11. Simple staining and differential staining (gram's staining)
- 12. Bacterial growth curve
- 13. Technique of micrometry (ocular and stage)

##### **Spotters:**

- 1. Osazone
- 2. Globular protein
- 3. Lock and key, model
- 4. Complete inhibition
- 5. RUBISCO
- 6. ATP synthase
- 7. Autoclave
- 8. Laminar air flow
- 9. Tyndalization

10. Bacterial growth curve
11. Hot air oven
12. Serial dilution technique

#### REFERENCE BOOKS

1. Lehninger Principles of Biochemistry By: David L. Nelson and Cox
2. Biochemistry By: Rex Montgomery
3. Harper's Biochemistry By: Robert K. Murray
4. Enzymes By: Trevor Palmer
5. Enzyme structure and mechanism By: AlanFersht
6. Principles of Biochemistry By: Donald J. Voet, Judith G.Voet, Charlotte W.Pratt
7. Analytical Biochemistry By: Cooper
8. Principles and techniques of Biochemistry and Molecular Biology Edited By: Keith Wilson
9. Practical Biochemistry By: Plummer
10. Biology of Microorganisms by: Brock, T.D. and Madigan, M.T.
11. Microbiology by: Prescott, L.M., Harley, J.P. Klein,D.A.
12. Microbiology by: Pelczar, M.J, Chan, E.C.S., Ereig,N.R.
13. Microbiological applications by: Benson

Robert

Rohini

Abhinav

P. H. Kumar



GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.  
AUTONOMOUS (CBCS)  
BSC BIOTECHNOLOGY-II YEAR (2021-22)  
Semester III- Molecular Biology and Recombinant DNA Technology

COURSE OUTCOMES

CREDITS-4 TEACHING HOUR/WEEK-

4

After completion of the course student will understand:

- Structural levels of nucleic acids- DNA and RNA and genome organization in prokaryotes and eukaryotes.
- The concept of Gene and the gene architecture.
- Molecular Events of Transcription and processing of transcripts
- The knowledge of recombinant DNA technology

**Unit 1: Nucleic Acids and Genome organization**

1.1 DNA as the genetic material- Griffith's experiments on transformation, Avery McCleod and McCarty experiment, Hershey-Chase experiment, RNA as Genetic Material

1.2 Genome organization in prokaryotes and Eukaryotes

1.3 Genome organization in Mitochondria and Chloroplast genome

1.4 DNA replication- Semi conservative DNA replication-Messelson and Stahl experiment

1.5 Replication in Prokaryotic Genome and Nuclear Genome of Eukaryotes

1.6 Mutation-Spontaneous and Induced , Physical and chemical Mutagens

**2. Gene expression in prokaryotes and Eukaryotes**

2.1 Structure of prokaryotic and Eukaryotic gene ,Structure and functions of prokaryotic RNA polymerase

2.2 Transcriptional machinery of eukaryotes-Structure and functions of eukaryotic RNA polymerase

2.3 Genetic Code-Properties ,deciphering genetic code, wobble hypothesis

2.4 Prokaryotic Transcription- initiation, elongation , proof reading and termination (rho dependent and independent),

2.5 Eukaryotic Transcription- initiation, elongation and termination

2.6 Prokaryotic and eukaryotic- Translation- initiation, elongation and termination.

**3. Unit: Gene regulation in Prokaryotes and Eukaryotes**

3.1 Prokaryotic transcriptional regulation (inducible System)-Operon concept, Lac operon, glucose effect.

3.2 Prokaryotic transcriptional regulation (repressible system)- Tryptophan operon

3.3 Post transcriptional modifications – Capping and Poly adenylation

3.4 Splicing and alternate splicing

*Mahesh*

*D. Sanyal*

*Rohini*

*AD/*

*P. Ad Kura*

- 3.5 Post translational modification- glycosylation and adenylation and ubiquitination
- 3.6 Gal regulation in yeast-mating type gene switching

#### Unit 4: Recombinant DNA Technology *— Summary*

- 4.1 Enzymes useful in molecular cloning: Restriction endonuclease, DNA ligases, Polynucleotide kinase, DNA Polymerase, Klenow enzyme, reverse transcriptase, Alkaline phosphatase, terminal nucleotidyltransferase
- 4.2 Cloning Vectors: pBR322, Bacteriophage, Cosmid, Phagemid, Shuttle vectors
- 4.3 Vectors for library preparation (lambda phage vector, Cosmid, BAC and YAC)
- 4.4 Gene transfer techniques: Physical, Chemical and Biological methods
- 4.5 Selection of recombinant clones—colony hybridization and library screening
- 4.6 Polymerase Chain Reaction and Applications of recombinant DNA technologies—Agriculture, Medicine

#### PRACTICALS

#### MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY

1. Isolation of DNA from bacterial cell *3*
2. Isolation of DNA from Plasmid
3. Agarose gel electrophoresis of DNA
4. Quantification of DNA by Spectrophotometer
5. Separation of proteins by SDS-PAGE
6. Polymerase Chain Reaction
7. Restriction digestion of DNA
8. Bacterial Transformation (Selection of transformants with blue white selection)

#### REFERENCE BOOKS

1. Molecular Biology of the cell. Alberts, B; Bray, D, Lewis, J., Raff, M., Roberts, K and Watson, J.D. Garland publishers, Oxford
2. Molecular Biology of the Gene - By Watson, Hopkins, Goberts, Steitz and Weiner (Pearson Education)
3. Text Book of Biotechnology - By H.K. Das (Wiley Publications)
4. Gene Structure & Expression - By J.D. Howkins, Publ: Cambridge
5. Test Book of Molecular Biology - By K.S. Sastry, G. Padmanabhan & C. Subramanyan, Publ: Macmillan India
6. Principles of Gene Manipulation - By R.W. Old & S.B. Primrose, Publ: Blackwell
7. Genes - By B. Lewin - Oxford Univ. Press
8. Molecular Biology & Biotechnol. - By H.D. Kumar, Publ: Vikas
9. Methods for General & Molecular Bacteriology - By P. Gerhardt et al., Publ: ASM
10. Molecular Biotechnology - By G.R. Click and J.J. Pasternak, Publ: Panima
11. Genes and Genomes - By Maxine Singer and Paul Berg
12. Molecular Biology - By D. Freifelder, Publ: Narosa
13. Molecular biology. By; F. Weaver. WCB/McGraw Hill.

*Handwritten signature*

*Handwritten signature*

*Handwritten signature*

*P. Ad. Kar*



GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.  
AUTONOMOUS (CBCS)  
BSC BIOTECHNOLOGY-II YEAR (2021-22)  
SEMESTER- III  
SKILL ENHANCEMENT COURSE -2 (SEC- 2)  
BS 302: IMMUNOLOGICAL TECHNIQUES

1. Unit: Antibody assays - Principle, Methodology and Applications
  - 1.1. Antigen - Antibody reactions: opsonisation, neutralization, precipitation & agglutination
  - 1.2. Immuno diffusion & radial diffusion
  - 1.3. Immuno electrophoresis - rocket and counter current
  - 1.4. ELISA & western blotting
  - 1.5. Radioimmunity assay & immune fluorescent assay
  - 1.6. Immunohisto chemistry
2. Unit: Cellular Assays - Principle, Methodology and Applications
  - 2.1. Total and differential count in human peripheral blood
  - 2.2. Separation of mononuclear cells from human peripheral blood
  - 2.3. Cell viability assay using tryphan blue
  - 2.4. Lymphocyte transformation assay
  - 2.5. Enumeration of T & B cells from human peripheral blood
  - 2.6. Micro cytotoxicity assay for HLA typing

REFERENCE BOOKS

1. Essential Immunology by I. Roitt, Publ: Blackwell
2. Immunology by G. Reeve & I. Todd, Publ: Blackwell
3. Cellular and Molecular Immunology by Abbas AK, Lichtman AH, Pillai S. Saunders publication, Philadelphia
4. Kuby's Immunology by Golds RA, Kindt TJ, Osborne BA. W.H. Freeman and company, New York

Mahesh

Rohini

Abhinav

P. Ad. Kumar



GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.  
AUTONOMOUS (CBCS)  
BSC BIOTECHNOLOGY-II YEAR (2021-22)  
Semester IV (DSC – 1D)  
B S 405: Bioinformatics and Biostatistics

COURSE OUTCOMES CREDITS-4 TEACHING HOUR/WEEK-4

After completion of the course student will understand how to:

- Store and Retrieve drug related information using online tools
- Comprehend the utility of tools & databases available in genomic & proteomics
- Understand simple calculations, to plan and execute research designs
- Analyse data, interpret, information and compare observed data

**Unit 1: Introduction to Bioinformatics and Biological Databases**

- 1.1 Bioinformatics – a history, Scope and applications
- 1.2 Bioinformatics tools and resources, internet basics, role of internet, free online tools, downloadable tools
- 1.3 Bioinformatics web portals-NCBI, EBI, ExPASy
- 1.4 Biological databases: classification of Databases primary (Genbank), Secondary (PIR), Tertiary and composite (KEGG) databases
- 1.5 Sequence Databases – DNA sequence databases
- 1.6 Protein data sequence databases-(swissprot and PROSITE)

**Unit 2: Sequence Alignment**

- 2.1 Basics of sequence alignment – match, mismatch, gaps, gap penalties, scoring alignment
- 2.2 Types of sequence alignment- pairwise and multiple alignment, local and Global alignment
- 2.3 Dot matrix comparison of sequences
- 2.4 Scoring matrices – PAM and BLOSUM
- 2.5 Pair wise sequence similarity search by BLAST and FASTA
- 2.6 Concepts of phylogeny- distance based (NJ Method) and Character based (ML method) , Tree construction methods

**Unit 3: Descriptive Biostatistics and Probability**

- 3.1 Introduction to Biostatistics, kinds of data and variables, based on nature (numerical, discrete and continuous, categorical –ordinal and nominal), based on source (primary and secondary data) sample size, sampling methods and sampling errors
- 3.2 Data tabulation and representation methods, graphical methods(stem and leaf plot, line diagram, bar graphs, histogram, frequency polygon & frequency curve) diagrammatic method (pie diagram)
- 3.3 Measures of central tendency- arithmetic mean, median, mode (merits and demerits)
- 3.4 Measures of dispersion- range, mean deviation, variance and standard deviation, Standard error and Co efficient of Variation -merits and demerits



- 3.5 Concepts of probability-random experiment, events and Probability of an event, probability rules (addition and multiplication), uses of permutation and combinations, random variables (discrete and continuous)
- 3.6 Probability distributions-Binomial, Poisson for discrete variables and Normal distribution for continuous variables

#### Unit 4: Applications of Biostatistics

- 4.1 Hypothesis testing- steps in testing for statistical hypothesis, null and alternative hypothesis level of significance- type 1 and type 2 errors
- 4.2 Test of significance- for small samples- student's t- test (one sample and two samples)
- 4.3 Test of significance- for large samples – Z test for means and proportions
- 4.4 Chi-square test- and their applications –goodness of fit, test of independence
- 4.5 Analysis of Variance (ANOVA)- one way analysis
- 4.6 Correlation definition, simple linear analysis, Karl Pearson's correlation coefficient

#### OPTIONAL I: PRACTICALS BIOINFORMATICS AND BIOSTATISTICS

1. Exploring web portals NCBI, EBI &ExpASy
2. Literature search through Pubmed and Pubmed Central
3. Sequence retrieval from Genbank, ENA, Swissprot
4. Pairwise homology search by BLAST and FASTA
5. Calculation of mean, median, mode, standard deviation, variance, standard error and coefficient of variation
6. Construction of bar diagram, pie diagram, line diagram. histogram
7. Problems on hypothesis testing using Z- test. t-test and Chi-square test
8. Problems on probability and probability distributions

#### Spotters

1. Line diagram, bar diagram & pie diagrams
2. Histogram, frequency polygon & frequency curve
3. Normal Probable curve
4. GenBank
5. DDBJ
6. SWISS-PROT
7. PROSITE
8. PIR
9. BLAST
10. Pairwise alignment
11. Multiple sequence alignment
12. PAM and BLOSUM
13. Phylogenetic tree



P. H. K.



## RECOMMENDED BOOKS

1. Khan & Khanum (2004), Fundamentals of Biostatistics, 11 Revised Edition, Ukaaz Publication
2. Bailey, N.T.J., Statistical methods in Biology, Cambridge Univ. Press
3. Fundamentals of Biostatistics, P HanmanthRao and K.Janardhan
4. Danial, W. W, Biostatistics, Wiley
5. Introduction to Bioinformatics by Aurther M lesk
6. Developing Bioinformatics Computer Skills by: Cynthia Gibas, Per Jambeck
7. Bioinformatics second edition by David M mount
8. Essential Bioinformatics by Jin Xiong
9. Bioinformatics Computing by Bryan Bergeron
10. Bioinformatics: Concepts, Skills & Applications by R.S. Rastogi
11. Queen, J. P., Quinn, G. P., & Keough, M. J. (2002). *Experimental design and data analysis for biologists*. Cambridge University Press
12. Mahajan, B.K. (2002). Methods in biostatistics. Jaypee Brothers Publishers

*Rohini*

*AD*

*P. Ad. Kumar*

*Mohini*

*Dharmy*



GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.  
AUTONOMOUS (CBCS)  
B.Sc BIOTECHNOLOGY II YEAR (2021-22)  
SEMESTER- IV  
SKILL ENHANCEMENT COURSE-3 (SEC-3)  
BS 401: MOLECULAR MARKERS IN PLANT BREEDING

**Unit 1: Molecular markers in Plant Breeding**

- 1.1. Types of markers - morphological, cytological, biochemical and genetic markers
- 1.2. Development of molecular markers - scope in plant breeding; criteria for ideal molecular markers
- 1.3. Types of molecular markers
- 1.4. Hybridization based molecular markers - RFLP
- 1.5. PCR based molecular markers - RAPD, SSRs, AFLP
- 1.6. Sequence based molecular markers - SNPs and DArTs

**Unit 2: Applications of Molecular markers in Plant Breeding**

- 2.1. Segregating populations - backcross, double haploid, F2&F3 families, RLLs
- 2.2. Linkage mapping and QTI, mapping
- 2.3. Marker Assisted Selection (MAS) - procedure and applications
- 2.4. Map based cloning of genes
- 2.5. Fingerprinting - fingerprinting genotypes; assessment of genetic similarity among genotypes; conservation, evaluation and use genetic resources
- 2.6. Hybrid testing

**REFERENCE BOOKS**

1. Gupta PK. 2010. Plant Biotechnology. Rastogi Publications.
2. Chawla FIS. 2011. Introduction to Plant Biotechnology. Oxford and IBH Publishing Co. PvtLtd.
3. Chittaranjan K. 2006-07. Genome Mapping and Molecular Breeding in Plants. Vols. I-VU. Springer. 16
4. Newbury HJ. 2003. Plant Molecular Breeding. Blackwell Publ. Weising K, Nybom H, Wolff K & Kahl G. 2005. DNA Fingerprinting in Plants: Principles, Methods and Applications. Taylor & Francis.

*John*

*P. H. K.*

*D. Somya*

*Moh*

GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.  
AUTONOMOUS (CBCS)

B.Sc BIOTECHNOLOGY III YEAR (2021-22)

SEMESTER- V

GENERIC ELECTIVE (GE)

BS 503: BASICS IN BIOTECHNOLOGY

COURSE OUTCOMES CREDITS-4 TEACHING HOUR/WEEK-2

After completion of the course student will understand:

- About various tissue culture techniques to culture by invitro techniques and molecular farming
- Various fermentation techniques and process of production of the fermented foods and chemicals
- Applications of animal cell culture and use the assisted reproductive technology in livestock and its applications.

1. Store and Retrieve drug related information using online tools and Comprehend the utility of tools & databases available in genomic & proteomics

**2. Unit: Agricultural Biotechnology**

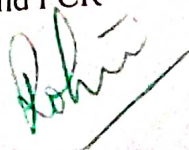
- 1.1. Plant tissue culture - media, sterilization, culture types
- 1.2. Micro-propagation, Synthetic seeds, Somatic hybrids and haploid plants
- 1.3. Transgenic plants - direct & indirect methods of gene transfer
- 1.4. Applications of transgenic plants - improving productivity & nutritional quality
- 1.5. Applications of transgenic plants - stress tolerant plants & molecular farming
- 1.6. Biofertilizers and biopesticides

**3. Unit: Microbial and Industrial Biotechnology**

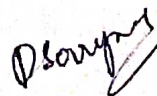
- 2.1. Exploitation of micro-organisms and their products
- 2.2. Isolation, screening and selection of microorganisms for industrial products
- 2.3. Preservation of microorganisms
- 2.4. Strain development and improvement, strategies of strain improvement selection and recombination
- 2.5. Production of recombinant DNA vaccine, amino acids, vitamins
- 2.6. Single cell protein, dairy products, and penicillin and streptomycin production


**Unit: Animal and Medical Biotechnology**

- 3.1. Cell culture technique and its applications
- 3.2. Animal breeding (selective breeding and cross breeding) and its limitations
- 3.3. *In vitro* techniques in animal improvement: *in vitro* fertilization & microinjection
- 3.4. Genetically modified animals: transgenic & knock-outs
- 3.5. Mouse models of disease: cancer and diabetes
- 3.6. Biotechniques: gel electrophoresis and PCR











**4. Unit: Computer applications in Biotechnology**

4.1. Scope of computer applications in Biotechnology

4.2. Biotechnology tools and resources - role of the internet, free online tools, downloadable free software

4.3. Biotechnology web portals — NCBI, EBI, ExPASy

4.4. Biological databases: classification of databases - the primary (Genbank), secondary (PIR) databases

4.5. Sequence databases - DNA sequence databases (ENA & DDBJ)

4.6. Protein sequence databases (Swissprot & PROSITE)

*P. Mohan*

*AD*

*P. Mohan*

*Mohan*

*P. Mohan*

GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.  
AUTONOMOUS (CBCS)

B.Sc BIOTECHNOLOGY III YEAR (2021-22)

SEMESTER- V

OPTIONAL- I (A) (DSE- 1E)

BS 504(A): PLANT BIOTECHNOLOGY

COURSE OUTCOMES CREDITS-4 TEACHING HOUR/WEEK-4

After completion of the course student will understand:

- About various tissue culture techniques to culture by invitro techniques.
- Applications in plant tissue culture for Secondary metabolite production.
- The applications of genetic engineering like transgenic plants.
- Molecular farming for commercially synthesizing products such as vaccines, proteins, enzymes, etc.

**1 Unit: Fundamentals of Plant Tissue Culture**

- 1.1. Introduction to Plant tissue culture, totipotency of plant cells (dedifferentiation, re differentiation and regeneration)
- 1.2. Nutritional requirements for plant tissue culture: nutrient media - macronutrients and micronutrients, media additives (carbon source, vitamins, amino acids); types of media
- 1.3. Plant growth regulators - auxins, cytokinins and gibberilins
- 1.4. Preparation of media, sterilization, selection & surface sterilization of explant, inoculation, incubation and culture of plant tissue *in vitro*
- 1.5. Induction of callus cultures and cell suspension cultures
- 1.6. Organogenesis and somatic embryogenesis

**2 Unit: Applications of Plant Tissue Culture**

- 2.1. Meristem culture, micropropagation and their applications
- 2.2. Encapsulation and production of synthetic seeds and their applications
- 2.3. Cell suspension cultures (batch and continuous cultures) and applications
- 2.4. Protoplast isolation, culture and fusion - development of somatic hybrids & cybrids and their applications
- 2.5. Somaclonal variation and its applications
- 2.6. Anther and pollen culture for production of haploids & their applications
- 2.7. Cryopreservation - conservation of plant germplasm

**3 Unit: Production of Transgenic Plants**

- 3.1. Direct gene transfer techniques - physical methods: microinjection, particle bombardment (gene gun) and electroporation & chemical methods
- 3.2. Molecular mechanism of *Agrobacterium* infection and features of Ti Plasmid

*[Handwritten signature]*

*[Handwritten signature]*

*[Handwritten mark]*

*[Handwritten signature]*



- 3.3. Agrobacterium mediated gene transfer using binary and co-integrate vectors
- 3.4. Viral vectors for gene transfer into plants
- 3.5. Selection of transgenic plants using reporter and selection marker genes
- 3.6. Genome editing -

#### 4 Unit: Applications of Transgenic Plants

- 4.1. Herbicide resistance in transgenic plants - glyphosate tolerance
- 4.2. Insect resistant transgenic plants: Bt cotton, proteinase inhibitors, lectins
- 4.3. Virus, bacterial and fungal resistant transgenic plants
- 4.4. Abiotic Stress tolerance: drought, heat and salinity stress tolerant plants
- 4.5. Transgenic plants with enhanced nutritional value: vitamin A, oil, amino acids
- 4.6. Transgenic plants as bioreactors: edible vaccines, antibody production, biodegradable Plastics

*Seminars*

#### OPTIONAL-I (A): PRACTICALS PLANT BIOTECHNOLOGY

1. Preparation of media for plant tissue culture
2. Sterilization methods of explants (seed, leaf, inter node & root) and inoculation
3. Establishment of callus cultures - from carrot/rice
4. Preparation of synthetic seeds
5. Meristem culture
6. Cell suspension cultures
7. Protoplast isolation and culture
8. *Agrobacterium* mediated transformation

#### Spotters

1. Callus cultures
2. Sterilization techniques: autoclave and hot air Oven
3. Somatic embryos
4. Synthetic seeds
5. Meristem culture
6. Plant regeneration
7. Cell suspension cultures
8. Isolation of protoplasts
9. Particle bombardment (Gene gun)
10. Binary or co-integrate vectors
11. Gus gene expression in transgenic plant tissue
12. Golden Rice

*Dohia*

*D. Srinivas*

*P. M. K.*

*P. M. K.*

## REFERENCE BOOKS

1. Plant Tissue Culture and its Biotechnological Applications by W. Barz, E. Reinhard, M.H. Zenk
2. Plant Tissue Culture by Akio Fujiwara
3. Frontiers of Plant Tissue Culture by Trevor A. Thorpe
4. In vitro Haploid Production in Higher Plants by S. Mohan Jain, S.K. Sopory, R.E. Veilleux
5. Plant Tissue Culture : Theory and Practice by S.S. Bhojwani and A. Razdan
6. Plant Cell, Tissue and Organ Culture, Applied and Fundamental Aspects by Y.P.S. Bajaj and A. Reinhard

*Rohini*

*AB*

*P. Altman*

*Mohu*

*D. Seemys*



GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.  
AUTONOMOUS (CBCS)  
B.Sc BIOTECHNOLOGY III YEAR (2021-22)  
SEMESTER- VI  
OPTIONAL PAPER I

BS 601: IPR, BIOSAFETY AND ENTREPRENEURSHIP  
COURSE OUTCOMES CREDITS-4 TEACHING HOUR/WEEK-4

After completion of the course student will understand:

- Understanding, defining and differentiating different types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness
- Exposing to the Legal management of IP and understanding of real life practice of IPM.
- Containment of potentially harmful biological agents and to reduce or eliminate exposure of laboratory workers, environment to potentially hazardous agents.
- The routes of exposure for a pathogen to a human being and demonstrate and assess the proper use of PPE, best practices.

**1. Unit: Intellectual Property rights**

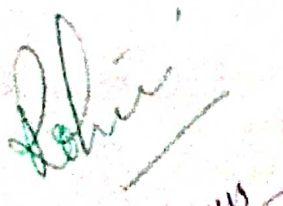
- 1.1. Intellectual Property - meaning, nature
- 1.2. Significance and need of protection of intellectual property
- 1.3. Types of intellectual property rights: patent, trademarks, copyright, design registration, trade secret, geographical indicators, plant variety protection
- 1.4. Copyright: meaning, nature, historical evolution and significance
- 1.5. Ownership of copyright - rights of authors and owners, trademarks
- 1.6. Plant varieties protection and plant breeding rights

**2. Unit: Patent laws**

- 2.1. Patents - concept of patent- historical overview of the patent law in India
- 2.2. Kinds of patents - procedure for obtaining patent in India and in other countries
- 2.3. Patenting microbes and organisms- novelty, International Depository Authorities (IDAs), submitting details of the deposit
- 2.4. Patenting genes - pros and cons, ethics, examples
- 2.5. Patenting markers and variants - examples
- 2.6. Product vs process patent - product life cycle and process design.

**3. Unit: Laboratory Management and Safety**

- 3.1. Administration of laboratories, laboratory design, laboratory information management system
- 3.2. Laboratory safety - good laboratory practice (GLP), biosafety levels
- 3.3. Basic principles of quality control (QC) and quality assurance (QA)
- 3.4. Handling of hazardous compounds - chemicals, solvents, poisons, isotopes, explosives and biological strains



- 3.5. Storage of hazardous material
- 3.6. Disposal of biological and radioisotope wastes

4. **Unit: Entrepreneurship**

- 4.1. Concept, definition, structure and theories of entrepreneurship
- 4.2. Types of start-ups with examples
- 4.3. Types of entrepreneurship. environment, process of entrepreneurial development 4.4. Entrepreneurial culture, entrepreneurial leadership
- 4.5. Product planning and development - project management, search for business idea, concept of projects, project identification
- 4.6. Promoting bio-entrepreneurship.

*Rohini*

*AD*

*Dsoumays*

*P. Ad. Kim*

*Adhikari*



GOVERNMENT DEGREE COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD.  
AUTONOMOUS (CBCS)

B.Sc BIOTECHNOLOGY III YEAR (2021-22)  
SEMESTER- VI

OPTIONAL- II (A) (DSE- 1F)

BS 604(A): ANIMAL BIOTECHNOLOGY

COURSE OUTCOMES CREDITS-4 TEACHING HOUR/WEEK-4

After completion of the course student will understand:

- To describe in vitro applications of animal cell culture
- To use the assisted reproductive technology practised in livestock and its applications
- To construct the techniques in production of cloned animal and its applications.
- To predict the ethical, social and moral issues related to cloning

**1. Unit: Animal cell culture: principles and applications**

- 1.1. Cell culture technique: cell culture media, sterilization techniques
- 1.2. Characteristic features of cell lines and cell line maintenance
- 1.3. Methods of isolation and separation of various cell types and establishment of cell lines
- 1.4. Properties and types of stem cells, culturing of embryonic stem cells and adult stem cells
- 1.5. Manipulation of cells: electroporation, transfection, transduction and microinjection
- 1.6. Applications of cell culture: manufacturing, toxicity testing and tissue engineering

**2. Unit: In vitro techniques in animal improvement**

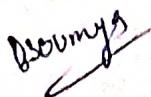
- 2.1. Principles of animal breeding: selective breeding, cross breeding and their limitations
- 2.2. Superovulation, collection of semen and ova
- 2.3. *In vitro* maturation of oocytes, artificial insemination
- 2.4. *In vitro* fertilization, embryo collection and embryo sexing
- 2.5. Somatic cell nuclear transfer, cloning of animals (example: Dolly)
- 2.6. Applications of in vitro techniques in animal improvement

**3. Unit: Molecular markers in animal genetics**

- 3.1. Developments in livestock genomics
- 3.2. Molecular markers: types and characteristics
- 3.3. RFLP and RAPD
- 3.4. SNPs and their application in genotyping
- 3.5. Identification and isolation of desired genes of interest
- 3.6. Marker-assisted selection

**4. Unit: Genetically modified organisms**

- 4.1. Animal models and their significance in scientific research
- 4.2. Mouse models for cancer
- 4.3. Generation of transgenic mouse
- 4.4. Generation of gene knock-out mouse
- 4.5. Genetically modified mice as disease models



4.6. Applications of genetically modified animals in understanding disease biology and drug development.

**OPTIONAL-I (A): PRACTICALS  
ANIMAL BIOTECHNOLOGY**

1. Preparation of animal cell culture media
2. Sterilization of cell culture media
3. Cell counting by microscopy
4. isolation of cells from chicken Liver
5. Establishment of primary cell culture: Liver/Spleen
6. Preparation of metaphase chromosomes
7. Culturing suspension cells
8. Culturing adherent cells

**Spotters**

1. Microscope
2. CO2 incubator
3. Biosafety cabinet/ Laminar air flow
4. Trypan blue stained cells
5. Cell culture flasks and dishes
6. Metaphase slide
7. Autoclave
8. Centrifuge
9. Example of an RFLP
10. Microinjection into egg cells

**REFERENCE BOOKS**

1. Text book of Animal Biotechnology by B Singh. The Energy and Resources Institute (teri)
2. Genetics for Animal Sciences by WH Freeman. Van Vleck LD, Pollak EJ & Bltenacu EAB. 1987.
3. Cancer Cell Culture: Methods and Protocols: 731 (Methods in Molecular Biology) Humana; 2nd ed. 2011 edition (28 April 2011)
4. Genetic Engineering by V.K. Agarwal and P.S. Varma, S. Chand & Company Ltd, 2009

Mahar  
Dohri

Shomya

P. H. Kim