



# SLN DEGREE COLLEGE

Alamur Road, Anantapuramu

Affiliated to S.K. University

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## Department of Bio-Technology

The Department of **BIOTECHNOLOGY** was started in the year 2016 with an UG Courses B.M.C (BIOTECH, MICROBIOLOGY, CHEMISTRY). In the year 2017 B.M.C (BIOTECH, MICROBIOLOGY, CHEMISTRY) was introduced.

The department is having well qualified and experienced faculty members. The faculty is a perfect blend of different specializations in **BIOTECHNOLOGY** and applications to impart their expertise in handling diversified courses of the UG programs. The teaching methodology in the department goes beyond fulfilling the syllabus requirements of the University, to meet the today's industry needs. Faculty motivates and guides the students to do mini projects in core subjects. Special focus will be given to develop Communication and Soft Skills. The Department adopted and made the ICT in teaching techniques effectively.

### Vision, Mission and Core Values

#### Vision

*"Attaining new heights in biotechnology research, shaping biotechnology into a premier precision tool of the future for creation of wealth and ensuring social justice – specially for the welfare of the poor."*

#### Mission

Biotechnology is a frontline area of science with immense potential for the benefit of the human kind. The Department shall devote wholly to achieve excellence in the promotion of biotechnology in the country within the ambit of the Allocation of Business Rules, 1961 as enumerated through the Government of India notifications No. CD-172/86 dated 27.2.86 and No. CD-87/87 dated 31.1.87. The Department shall provide services in the areas of research, infrastructure, generation of human resource, popularization of biotechnology, promotion of industries, creation of centers of excellence, implementation of biosafety guidelines for genetically modified organisms and recombinant DNA products and biotechnology-based

programs for societal benefits. Bioinformatics is a major mission to establish an information network for the scientific community, nationally and internationally. Our mission is:

- Realising full potential of biotechnology
- A well directed effort, significant investment for generation of products, processes and technologies
- Enhance efficiency and productivity and cost-effectiveness of agriculture, nutritional security, molecular medicine, environmentally sustainable technologies, scientific and technological empowerment of human resource, a strong infrastructure for research and commercialization, enhance the knowledge base, nurturing the leads of potential utility, bringing the bioproducts to the market place
- Socio-economic development / applicants of biotech for upliftment of women, rural, SC & ST population
- Promote biotech industry

#### **Core Values**

1. Integrity
2. Transparency and Accountability
3. Team work
4. Commitment
5. Excellence



**SRI KRISHNADEVARAY UNIVERSITY:: ANANTAPURAMU**

**UG CBCS SYLLABUS**

**VI Semester (2017-2018)**

**B.Sc., BIO-TECHNOLOGY**

**(AS PER CBCS AND SEMESTER SYSTEM) III YEARS**

**w.e.f. 2017-2018**

**AP STATE COUNCIL OF HIGHER EDUCATION CBCS - PATTERN FOR  
BIO-TECHNOLOGY**

**B.Sc., BIO-TECHNOLOGY VI SEMESTER- SYLLABUS**

**III YEAR –VI SEMESTER**

Paper–VII:Elective–A

**BTT- 601: ANIMAL AND PLANT BIOTECHNOLOGY**

Total: 56 hrs (3h /week)

**UNIT I: 16 h**

Animal cell and plant tissue culture: Introduction to animal cell culture and plant tissue culture laboratory facilities. Animal cell and plant tissue culture media (composition & preparation), sterilization. Role of growth factors in plant tissue culture.

**UNIT II: 12 h**

Various techniques of animal cell and plant tissue culture: Characteristics of animal cells in culture: Contact inhibition, anchorage dependence. Stem cells and their applications. Types of animal cell culture: Primary culture, secondary, subculture, suspension and cell lines. Maintenance of cell lines in the laboratory.

**UNIT III: 10 h**

Plant tissue: Micropropagation or clonal propagation, production of haploids, protoplast culture and somatic hybridization. Cloning in plants with Ti- plasmid. Concept of transgenic plants (Bt cotton and other transgenic plants) and applications.

UNIT IV: 10 h

rDNA products: Brief idea about recombinant DNA products in medicine (insulin, somatostatin, vaccines), Concept of Gene therapy, Production of recombinant vaccines – hepatitis. Concept of transgenic animals: In vitro fertilization and embryo transfer in humans and farm animals (e.g., Doly).

UNIT V: 8 h

IPR: Intellectual property rights. Protection of Copy rights. Patents and their significance. Management studies: society and ethical aspects of Biotechnology.

**PRACTICALS: BTP- 602 ANIMAL AND PLANT BIOTECHNOLOGY (2 h /week)**

Preparation of Plant tissue culture media (MS medium).

Cell count by hemocytometer.

Induction of Callus & Regeneration of plant.

Establishing primary cell culture of chicken embryo fibroblasts.

Animal tissue culture – maintenance of established cell lines.

Micropropagation of plant.

Measurement of cell size.

Microphotography.

IMViC test.

Determination of seed viability.

Note: Minimum of 6 practicals should be performed.

(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/ virtual labs etc.)

**RECOMMENDED BOOKS**

Lasley JF. Genetics of Livestock Improvement

Text book of Animal Biotechnology by B Singh. The Energy and Resources Institute (teri)

Ross CV. Sheep Production and Management. Prentice Hall

Schmidt GM & Van Vleck LD. Principles of Dairy Science. WH Freeman

Turner HN & Young SSY. Quantitative Genetics in Sheep Breeding. MacMillan

Van Vleck LD, Pollak EJ & Bltenacu EAB. Genetics for Animal Sciences. WH Freeman

Crawford RD. Poultry Breeding and Genetics. Elsevier

Singh RP & Kumar J. Biometrical Methods in Poultry Breeding. Kalyani

Plant Tissue Culture and its Biotechnological Applications By W. Barz, E. Reinhard, M.H. Zenk

Plant Biotechnology – H S Chawla

Plant Tissue Culture By Akio Fujiwara

Frontiers of Plant Tissue Culture By Trevor A. Thorpe

Plant Tissue Culture : Theory and Practice By S.S. Bhojwani and A. Razdan

Plant Cell, Tissue and Organ Culture, Applied and Fundamental Aspects By Y.P.S. Bajaj and A. Reinhard

Biotechnonology by U. Sathyanarayana

## **B.Sc., BIO-TECHNOLOGY VI SEMESTER- SYLLABUS**

### **B. Sc. III – Semester VI (Cluster A1 Elective)**

BTT 605 METABOLISM AND GENETICS (VIII A1 Elective)

Total: 60 h (3 h/week)

UNIT I: Carbohydrate metabolism 12 h

Glycolysis, Citric acid cycle, Electron transport chain, Gluconeogenesis and HMP shunt.

UNIT II: Amino acid and Lipid metabolism 12 h

Deamination, transamination & Decarboxylation of amino acids. Aromatic amino acid's Catabolism (Phenylalanine and tyrosine).  $\beta$ - Oxidation of fatty acids and fatty acid synthesis.

UNIT III: Mendel's Experiments 12 h

Mendel's Experiments – Laws of Segregation, Purity of gametes & Independent assortment. Deviations of Mendel's Laws - Partial or incomplete dominance, Codominance, Penetrance, Expressivity, Pleiotropis, pleiotropism, Recessive and Dominant gene interactions.

UNIT IV: 12 h

Gene mutation- Spontaneous and induced- Point and Frame shift. DNA Damage and DNA Repair- Excision repair and mismatch repair.

UNIT V 12 h

Giant Chromosomes – Polytene & Lamp brush. Cell cycle and Cell division, Apoptosis.

PRACTICALS BTP 606: GENETICS (Elective Lab)

Study of different phases of mitosis in onion root tips and meiosis in *Allium cepa* flower buds. Chromosome staining.

Determination of multiple allele frequencies of leaf scars in *Trifolium*.

Monohybrid and Dihybrid ratio in *Drosophila* or Maize (Models / Problems).

Determination of linkage and calculation of recombination frequencies (maize/ *Drosophila*).

Induction of chromosomal aberrations by chemical mutagenesis in *Allium* (or any plant).

Isolation of auxotrophic mutants (plants or insects).

Repair of DNA by Photo activation of Photolyase in bacteria.

Mutation of bacteria by UV light.

Chemical induced mutation in bacteria

Stages in Mitosis

Stages in Meiosis.

Note: Minimum of 8 practicals should be performed.

(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

Recommended Books:

Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.

Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.

Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.

Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.

Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.

B.Sc., BIO-TECHNOLOGY VI SEMESTER- SYLLABUS

B. Sc. III – Semester VI (Paper VIII: Cluster Elective A2)

BTT: 607 Industrial Biotechnology Total: 50 h (3h /week)

Unit I: 10 h

Isolation, screening and preservation of industrially important microorganisms. Synthetic and natural medium, antifoams, sterilization methods and inoculum preparation.

Unit II: 10 h

Definition of bioreactor, basic principles of bioreactor. Classification of bioreactors. Analysis of batch, continuous, fed batch and semi-continuous bioreactors.

Unit III: 10 h

Ethanol Production by Fermentation using Molasses, Starchy Substances. Production of Alcoholic Beverages like Beer and Wine. Production of Citric Acid by Submerged and Solid State Fermentations.

Unit IV: 10 h

Sources of Industrial Enzymes, Production of Microbial Enzymes like Amylase and protease. Backer's Yeast and SCP Production. Production of Antibiotics: Penicillin.

Unit V: 10 h

Biotechnology Products- Production of recombinant proteins having therapeutic and diagnostic applications (Insulin, Growth Hormone, Recombinant vaccines, Monoclonal Antibody).



## PRACTICALS BTP: 608 Industrial Biotechnology (2 h/week)

Isolation of industrially important microorganisms from soil.  
Isolation of amylase producing organisms from soil.  
Production of  $\alpha$  – amylase from *Bacillus* Spp. by shake flask culture.  
Production of alcohol or wine using different substrates.  
Estimation of alcohol by titrimetry.  
Estimation of alcohol by calorimetric method.  
Production of citric acid.  
Citric acid production by submerged fermentation.  
Estimation of citric acid by titrimetry.

Note: Minimum of 5 practicals should be performed.

(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/ virtual labs etc.)

### Recommended Books

Bioprocess Engineering - By Shuler (Pearson Education)  
Text Book of Biotechnology - By H.K. Das (Wiley Publications)  
Biotechnology -By H.J. Rehm and G. Reed. VIH Publications, Germany  
Biogas Technology - By b.T. Nijaguna  
Biotechnology - By K. Trehan  
Industrial Microbiology - By L.E. Casida  
Food Microbiology - By M.R. Adams and M.O. Moss  
Introduction to Biotechnology - By P.K. Gupta  
Essentials of Biotechnology for Students - By Satya N. Das  
Biotechnology, IPRs and Biodiversity - By M.B. Rao and Manjula Guru (Pearson Education)  
Essentials of Biotechnology - By Irfan Ali Khan and AtiyaKhanum (Ukaaz Publications)  
Bioethics – Readings and Cases - By B.A. Brody and H. T. Engelhardt. Jr. (Pearson Education)

## B.Sc., BIO-TECHNOLOGY VI SEMESTER- SYLLABUS

B. Sc. III – Semester VI (Paper VIII: Cluster Elective A3)

### BTT: 609 ENVIRONMENTAL BIOTECHNOLOGY

Total: 56 h (3h /week)

Unit I: Ecosystem 10h

Principles of Ecology, Bio-geo chemical cycles – Carbon and Nitrogen cycles. Role of microbes in bio-geochemical cycles.

Unit II: Environmental Pollution 10h

Introduction to environment and pollution. Sources of pollution – domestic waste, agricultural waste, industrial effluents and municipal waste. Inorganic and Organic pollutants of air, land and water and prevention of pollution.

Unit III: Bioenergy and Bio-fuels 10h

Renewable and non-renewable energy resources. Conventional energy sources and their impact on environment. Non-conventional fuels and their impact on environment. Production of biofuels:- biomethane, biohydrogen

Unit IV: Waste water management 10h

Types of pollutants in water. Aerobic and anaerobic treatment, primary, secondary, tertiary treatment of municipal wastes and Solid waste management

Unit V: Bioremediation and Restoration of Environment 16h

Introduction to Bioremediation. Microbial bioremediation of pesticides. Microbial degradation of pesticides and toxic chemicals. Biopesticides and Biofertilizers (Nitrogen fixing, phosphate solubilizing microorganisms)

BTP 610:Projectwork:Projectwork should be carried out by student in any field/topic which is covered during the course.

Suggested Books:

Environmental Science, S.C. Santra

Environmental Biotechnology, Pradipta Kumar Mohapatra

Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Josef Winter

Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill

Agricultural Biotechnology, S.S. Purohit

Introduction to Environmental Biotechnology, Milton Wainwright

Principles of Environmental Engineering, Gilbert Masters

Wastewater Engineering – Metcalf & Eddy

Text Book of Biotechnology - By H.K. Das (Wiley Publications)

Biotechnology -By H.J. Rehm and G. Reed. VIH Publications, Germany

Biogas Technology - By B.T. Nijaguna

Biotechnology - By K. Trehan

Industrial Microbiology - By L.E. Casida

Introduction to Biotechnology - By P.K. Gupta

Essentials of Biotechnology for Students - By Satya N. Das

Bioethics – Readings and Cases - By B.A. Brody and H. T. Engelhardt. Jr. (Pearson Education)

Biotechnology, IPRs and Biodiversity - By M.B. Rao and Manjula Guru (Pearson Education)

Bioprocess Engineering - By Shuler (Pearson Education)

Model Question Paper for End Semester Exam

B. Sc Degree Course (CBCS Semester pattern)

B. Sc Biotechnology

Time : 3 Hrs Max marks : 75

SECTION A (5 x 5 = 25 marks )

Unit I

Unit I

Unit II

Unit II

Unit III

Unit III

Unit IV

Unit IV

Unit V

Unit V

Attempt any FIVE of the following

SECTION – B (10 X 5 = 50 marks)

9.

10.

11.

12.

13.

14.

15.

16.

17.

18

Attempt all the questions

(OR) Unit I

(OR) Unit-II

(OR) Unit-III

(OR) Unit IV

(OR) Unit V

**Courses / Programs offered:**

Level	Course
UG	B.M.C (Biotechnology, Microbiology, Chemistry).

**Course Structure under CBCS:**

**Program outcomes, Course outcomes:**

Program Outcomes	
<b>Po1</b>	Develop ability to analyze a problem, identify and define the computing requirements, which may be appropriate to its solution.
<b>Po2</b>	To prepare students to undertake careers involving problem solving using computer science and technologies.
<b>Po3</b>	Develop ability to pursue advanced studies and research in computer science.
<b>Po4</b>	To produce entrepreneurs who can innovate and develop software product.

Program outcomes. Program specific outcomes, Course outcomes

Program outcomes
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PO1	Critical Thinking: <b>The curriculum made for the betterment of the students; enhance the ability and thinking power of the students</b>
PO2	<b>Students can know the basic technology of molecular biology and genetics. Study bioreactors for environmental applications.</b>
PO3	Social Interaction: <b>Due to continuous interaction with students in terms of various program run by department i.e. Curiosity Thirsty For Knowledge program, Celebration of 'Birth Day' of Teaching Staff and Students, Extension activity. Helps to increase Social Interaction.</b>
PO4	Effective Citizenship: <b>Being the students of microbiology they have to communicate with people, They have developed skills in Interactions among themselves and participating in blood grouping test.</b>

PO5	<b>Ethics: The subject teaches students about the ethics and awareness about microbial diseases and loss of patent</b>
PO6	<b>Environment and Sustainability: Integrate information for life long learning.</b>

### **Program Specific outcomes**

PO1	<b>acquire knowledge on the fundamentals of biotechnology and sound and solid base which enables them to understand the emerging and advanced engineering.</b>
PO2	<b>Students are also expected to develop and provide expert advice to society in science, technology and engineering.</b>
PO3	<b>Students should learn how to conduct an experiment (or series of experiments) demonstrating their understanding of the scientific methods and comprehensive technical expertise..</b>
PO4	<b>Students will develop the proficiency by doing different types of diagnosing tests using a variety of laboratory. instruments and in the analysis and interpretation of such serological tests.</b>
PO5	<b>Students will learn the applications of techniques for modeling microbiologyfor which analytical methods are inappropriate or of limited utility.</b>
PO6	<b>Students can learn role of microorganisms as biotechnological agents.</b>
PO7	<b>Describe the methodology of science and the relationship between observation and theory.</b>
PO8	<b>Learn master the basis terminology of molecular biology and genetics and about different types of vaccines given for different types of diseases.</b>
PO9	<b>Discover of microbial concepts in other disciplines and study bioreactors for environmental applications, y</b>
PO10	<b>Develop the following experimental instruments: autoclave, incubator, laminar air flow helpful for preparation of culture media and isolation of microorganisms</b>
PO11	<b>Provide expert advice to society in science, technology and engineering</b>

## COURSE OUTCOMES

### SEMISTER-1

TITLE OF COURSE –Macromolecules and bio physical techniques

**On successful completion of this course**

- 1.understand spectrum of light**
- 2. Understand beers lamber**
- 3.understand electrophoresis**
- 4.SDSPAGE electrophoresis**
- 5.Understand chemical structure of nucleic**
- 6.Understand about watsons crick model**
- 7.Classification of carbohydrates**
- 8.Explanation about lock and key model of**
- 9.Brief account on LIPIDS classification**
- 10.understand concept of PCR**

### SEMISTER-2

TITLE OF THE COURSE- Microbiology cell and molecular biology

**On successful completion of this course**

- 1.Understanding of development of microbiology**
- 2.Evaluate and instrumentation of compound**
- 3.understand dark field microscope**
- 4.understand transmission electron**
- 5.understand scanning electron**
- 6.understand about gram stainingtechnique**

### **SEMESTER-3**

TITLE OF THE COURSE- immunology and r-dna technology

**On successful completion of this course students will**

- 1.Understand organs and cells of immune**
- 2.understand acquired immune system**
- 3.understand antigen and antibody mechanism**
- 4.Brief account on cell mediated**
- 5.understand hypersensitivity**
- 6. Idea about ELISA test**

### **SEMESTER-4**

TITLE OF THE COURSE- paper1( plant and animal biotechnology)

**On successful completion of this course students will**

- 1. understand ms media proparation.**
- 2. understand plant tissue culture medium**
- 3. Understand synthetic seed preparation**
- 4- understanding applications of gene therapy**
- 5 understanding applications of Transgenic**

TITLE OF THE COURSE- paper2 ( industrial and environmental  
biotechnology)

On successful completion of course students will

- 1 classification of Bioreactor**
- 2. understand Gogas production**
- 3.understand production of wine**
- 4. Understand production of Beer**
- 5. Understand Bioremediation**

## **Semester-5**

TITLE OF THE COURSE- paper1(organic farming)

### **On successful completion of course students will**

- 1. understand Types of soils**
- 2. understand micro and macro nutrient**
- 3. understand applications of rotation crops**
- 4. understand applications of Azospirillum**
- 5. mechanism of Nitrogen fixation**

TITLE OF THE COURSE- paper 2 (Biofertilizer and Bio pesticides)

### **On successful completion of course students will**

- 1.understanding application of Biofertilizers**
- 2.understanding application of Bio pesticides**
- 3.understand mycorrhizalfertilizers**
- 4.understand mass production techniques**
- 5.Understand feild application methods.**



REVISED UG SYLLABUS UNDER CBCS  
(Implemented from Academic Year 2020-21)  
PROGRAMME: FOUR YEAR B.Sc.

Domain Subject: **BIOTECHNOLOGY**

Skill Enhancement Courses (SECs) for Semester V,

from 2022-23 (Syllabus-Curriculum)

Structure of SECs for Semester – V

*(To choose One pair from the Three alternate pairs of SECs)*

Univ. Code	Courses 6&7	Name of Course	Th. Hrs/Week	IE Marks	EE Marks	Credits	Prac. Hrs/wk	Marks	Credits
	6A	Techniques in nursery development	3	25	75	3	3	50	2
	7A	Hydroponics cultivation	3	25	75	3	3	50	2

OR

Univ. Code	Courses 6&7	Name of Course	Th. Hrs/Week	IE Marks	EE Marks	Credits	Prac. Hrs/wk	Marks	Credits
	6B	Organic Farming	3	25	75	3	3	50	2
	7B	Biofertilizers and Biopesticides production	3	25	75	3	3	50	2

OR

Univ. Code	Courses 6&7	Name of Course	Th. Hrs/Week	IE Marks	EE Marks	Credits	Prac. Hrs/wk	Marks	Credits
	6C	Apiculture	3	25	75	3	3	50	2
	7C	Pearl Culture	3	25	75	3	3	50	2

**Note-1:** *For Semester–V, for the domain subject Biotechnology any, any one of the three pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C & 7C. The pair shall not be broken (ABCD allotment is random, not on any priority basis).*

**Note-2:** *One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate field skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented.*

*Hence, teachers shall also impart practical training to students on the field skills embedded in the syllabus citing related real field situations*

Semester-wise Revised Syllabus under CBCS,2020-21

Four Year B.Sc.

Course Code:

Domain Subject: Biotechnology

IV year B.Sc.-Semester-V

**Course: 6 A -Techniques in Nursery**

**Development** (Skill enhancement course (Elective),

05 credits) Maximum Marks Theory: 100 +

Practical: 50

**I. Learning outcomes:**

Students after successful completion of the course will be able to

1. Understand different types of nurseries
2. Identify various facilities required to set up of a nursery
3. Understand expertise related to various practices in a nursery
4. Acquire skills to get an employment or to become an entrepreneur.

**II. Syllabus:** (Total 90 hrs. (including Teaching, Lab, Field Training and unit test setc.))

**UNIT -1: Introduction to Nursery**

(10h)

Definition, objectives and importance. Basic requirements for a nursery layout and components of a good nursery. Types of nurseries. Bureau of Indian standards (BIS - 2008) related to nursery.

**UNIT-2: Nursery inputs**

(10h)

Tools, implements and containers. Nursery media. Electricity, equipment and machinery management. Types of nursery beds and their preparations. Precautions and maintenance of nursery beds.

**UNIT -3: Seeds and Propagules**

(10h)

Selection of seed and different sowing methods. Use of different plant parts for vegetative propagation to raise nursery. Different techniques of vegetative propagation.

**UNIT- 4: Management Practices**

(10h)

Routine seasonal operations in a nursery. Supply of water, nutrients and removal of weeds. Identification of pests and diseases, control and prevention methods.

**UNIT – 5: Grafting techniques**

(10h)

Introduction to grafting, definition, types and tools for grafting. Steps involved in simple, splice graft, tongue graft, Whip graft, cleft graft and wedge graft. Grafting of horticultural & floricultural crops and applications.

**Practical syllabus: Course 6A: Techniques in Nursery Development**

**III. Skill outcomes:**

On successful completion of the practical course, student shall be able to

1. List out different types of nurseries and beds.
2. Identify the nursery tools, implements and containers.
3. Develop skill on potting media preparation and plant production.
4. Learn the technique of establishing cutting, layering, grafting etc

**IV. Practical syllabus:**

1. Demonstration of different types of nurseries
2. Handling of nursery tools, equipment and types of containers
3. Laying of nursery bed with soil and compost

4. Seed collection, treatment and rising of seedlings on nursery bed
5. Handling of grafting and layering techniques in the nursery
6. Watering, weeding and management of nursery
7. Maintaining of the seedlings / cuttings in the nursery

#### V. References:

1. Ratha Krishnan, M., *et al.* (2014) Plant Nursery Management: Principles and Practices, Central Arid Zone Research Institute–ICMR, Jodhpur, Rajasthan.
2. VikasKumar, Anjali Tiwari, Practical manual of Nursery management, Agri – biotech Press, New Delhi.
3. TaraiRanjan Kumar, (2020) Plant propagation and nursery management, New India Publishers.
4. P.K.Ray, (2020) Essentials of plant nursery management.
5. P.K.Ray, (2012) How to start and operate a Plant Nursery.

#### VI. Co-curricular activities:

##### a) Mandatory: (Training of students by teacher on field related skills:15hrs)

1. **For teachers:** Training of students by teacher in laboratory and field for a total of 15hrs on nursery types and infrastructure of a nursery. Presowing treatment and seed sowing methods. Plucking, transplantation, layering and grafting methods
2. **For students:** Visit to local nursery farm, observing the crop growth raised in nurseries. Submission of field work report of 10 pages in the prescribed format.
3. Maximum marks for field work report:05
4. Suggested format for field work report: Title page, student details, content page, introduction, work done, findings, conclusion and acknowledgements.
5. Unit test(IE)

##### b) Suggested co-curricular activities:

1. Visit to local nurseries
2. Learning techniques of basic tools and instruments handling related to fieldwork
3. Sowing of seeds by adopting different methods, grafting and layering techniques
4. Training of students by related subject experts
5. Attending special lectures, group discussions and seminars on related topics
6. Preparation of videos on nursery media preparation and application

**VII. Suggested Question Paper Pattern:**

Max.Marks: 75

Time: 3hrs

SECTIONA (Total: 15Marks)  
Very Short Answer Questions (10 Marks: 5 x2)  
SECTIONB (Total: 5x5=25Marks)  
(Answer any four questions. Each answer carries 5 marks (At least 1 question should be given from each Unit))

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

SECTIONC (Total: 4x10 = 40Marks)  
(Answer any four questions. Each answer carries 10 marks (At least 1 question should be given from each Unit))

1.	
2.	
3.	
4.	
5.	
6.	

**Suggested Question Paper Model for Practical Examination**

Semester – V/ Biotechnology **Course – 6 A** (Skill Enhancement Course) **Techniques in Nursery Development**

Max. Time:3Hrs.

Max. Marks: 50

- 1. Perform the pre-treatment method for given seed 'A' 8 M
- 2. Identify the graft and perform rafting 'B' 8 M
- 3. Demonstration of handling of nursery tools, equipment and containers 'C' 12 M
  
- 4. Scientific observation and data analysis 4 x 3 = 12M
  - A. Whipgraft /photograph
  - B. Propagule /photograph
  - C. Nursery container/photograph
  - D. Sucker/photograph
  
- 5. Record + Viva-voce 6+4 = 10M

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Semester-wise Revised Syllabus under CBCS,2020-21

Four Year B.Sc.

Course Code:

Domain subject: Biotechnology

IV year B.Sc.-Semester-V

**Course: 7 A - Hydroponics cultivation**

(Skill enhancement course (Elective), 05 credits)

Maximum Marks Theory: 100 + Practical: 50

**I. Learning outcomes:**

Students after successful completion of the course will be able to

1. Understand the concept of hydroponics
2. Acquire the knowledge on soilless cultivation system
3. Prepare media for hydroponics cultivation
4. Learn the hydroponic cultivation technique

**II. Syllabus:** (Total 90 hrs. including Teaching, Lab, Field Training and unit tests etc.)

**UNIT -1 - Introduction to Soillessculture**

(10h)

Definition, History and origin of soilless culture, Present status of hydroponics-contrasts with soil based culture, Applications & future developments.

**UNIT-2- Macronutrients, micronutrients**

(10h)

Functions and effect on plants, deficiency symptoms of the following essential minerals N, P, Mg, Ca, K, S, Fe, Mn, Cu, Zn, B, Mo, Physical factors, light (Quantity, energy, photoperiodism etc), Temperature (Heating and cooling), Humidity, CO<sub>2</sub>, ppm, pH and TDS.

**UNIT -3 -Cultural conditions**

(10h)

Plant nutrition. Inorganic salts (fertilizers) major and minor nutrients formulating, monitoring and analysing. Selection of fertilizers, media used for hydroponics-expanded clay, rock wool, coir, perlite, pumice, vermiculite, sand gravel etc. Weed management, diseases and pest control.

**UNIT- 4 - Techniques in hydroponics**

(10h)

Static solution culture, continuous-flow solution culture and aeroponics.

**UNIT -5 - Cultivation of crop plants by hydroponics**

(10h)

Passive sub-irrigation, Ebb and flow or flood and chain irrigation. Deep water culture protocols for –Tomato cultivation through Dutch bucket method, chilly cultivation through NFT system, Spinach through raft System and measurements of yield.

**Practical syllabus: Course 7A: Hydroponics cultivation**

**III. Skill outcomes:**

On successful completion of the practical course student shall be able to

1. List out macronutrients, micronutrients- functions and effect on plants, deficiency symptoms.
2. Demonstrate the importance of temperature and light in hydroponics
3. Develop skill of media production for Hydroponics cultivation
4. Equip with the skill of weed management, diseases and pest management

#### IV. Practical syllabus:

1. Handling of tools required for hydroponic setup
2. Preparation of macronutrients and micronutrients solutions/stock cultures
3. Preparation of different media for hydroponic system.
4. Evaluating the effect of bio fertilizers on hydroponic cultivation
5. Weeding management techniques -demonstration
6. Demonstration of pests and diseases control and prevention methods
7. Cultivation of tomato by hydroponic system
8. Cultivation of chilli through hydroponic cultivation

#### V. References:

1. Keith Roberto, *How to Hydroponics*. The future Garden Press New York. 4<sup>th</sup> Edition
2. Howard M. Resh. *Hobby Hydroponics*. CRC Press, USA.
3. Prasad S and Kumar U. *Green House management for Horticultural crops*. Agro-Bios India.
4. Dahama A.K. *Organic Farming for Sustainable Agriculture*. Agrobios, India
5. Subba Rao N.S. (1995). *Biofertilizers in Agriculture and Forestry*. Oxford and IBH Publishing Company. Pvt. Ltd New Delhi.

#### VI. Co-curricular activities:

##### a) Mandatory: (Training of students by teacher on field related skills: 15hrs)

1. **For teachers:** Training of students by teacher in laboratory and field for a total of 15hrs on soilless culture system. Demonstrating importance of nutrients/light/temperature for successful hydroponic cultivation.
2. **For students:** Visit to local Hydroponics cultivation farm, observing the crop growths. Submission of field work report of 10 pages in the prescribed format.
3. Maximum marks for field work report: 05
4. Suggested format for field work report: Title page, student details, content page, introduction, work done, findings, conclusion and acknowledgements.
5. Unit test (IE)

##### b) Suggested co curricular activities:

1. Visit to local hydroponics cultivation farm
2. Learning techniques of basic tools and instruments handling related to hydroponics
3. Training of students by related subject experts
4. Preparation of videos on media preparation and application in hydroponics
5. Attending special lectures, group discussions and seminars on related topics

**VII. Suggested Question Paper Pattern:**

Max.Marks: 75

Time: 3hrs

**SECTIONA** (Total: 15Marks)  
Very Short Answer Questions (10 Marks: 5 x2)

**SECTIONB** (Total: 5x5=25Marks)  
(Answer any four questions. Each answer

carries 5 marks (At least 1 question should be  
given from each Unit)

1.	
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**SECTIONC** (Total: 4x10 = 40Marks)  
(Answer any four questions. Each answer carries

10 marks (At least 1 question should be given  
from each Unit)

1.	
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**Suggested Question Paper Model for Practical Examination**

Semester – V/ Biotechnology **Course – 7 A** (Skill Enhancement

Course) **Hydroponics cultivation**

Max. Time:3 Hrs.

Max. Marks: 50

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1. Demonstrate the preparation of macronutrients and micronutrients stock solutions for hydroponics cultivation ‘A’ 8 M
2. Establish hydroponic set up with given tools‘B’ 8 M
3. Prepare complete media for effective hydroponic cultivation‘C’ 12 M
4. Scientific observation and data analysis 4 x 3 = 12M
  - A. Chilli cultivation/photograph
  - B. Tomato cultivation /photograph
  - C. Zinc deficiency symptom /photograph
  - D. Static solution culture/photograph
5. Record+Viva-voce 6+4 = 10M

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Semester-wise Revised Syllabus under CBCS,2020-21

Four Year B.Sc.

Course Code:

Domain subject:

Biotechnology IV year B.Sc., -  
Semester-V **Course 6B**

**Organic Farming**

(Skill enhancement course (Elective), 05 credits)

Maximum Marks Theory: 100 + practical: 50

**I. Learning outcomes**

Students after successful completion of the course will be able to

1. Understand the soil profile and nutrients in soil
2. Appreciate the importance of organic manure and biofertilizers
3. Produce vermi compost, farmyard manure from biowaste
4. Acquire skill on isolation and maintenance of biofertilizers

**II. Syllabus:** (Total 90 hrs. (including Teaching, Lab, Field Training and unit test setc.))

**UNIT -1-Soil:**

(10h)

Definition, soil formation, composition and characteristics. Types of soils. Distribution of soil groups in India. Acidic, Alkaline and heavy metal contaminated soil. Methods of reclamation. Effects of chemical dependant farming on yield and soil health.

**UNIT-2 -Plant Nutrition**

(10h)

Macro and micro nutrients, functions of nutrients in plant growth and development. Nutrient uptake and utilization by plant. Types of fertilizers. Organic, inorganic and bio fertilizers. Chemical fertilizer. Advantages & disadvantages of their use. Importance of organic and bio fertilizers.

**UNIT -3 -Organic Farming**

(10h)

Definition, concept, benefits. Integrated farming system (combination of organic and inorganic). Mixed farming system. Concept of different cropping systems in relation to organic farming, Inter cropping, crop rotation. Organic farming process. Organic fertilizers, crop nutrients and effective microorganisms in Organic farming.

**UNIT- 4 -Organiccompost**

(10h)

Definition, types of compost, farm yard compost, green leaf compost, animal husbandry, animal housing, animal feeding, animal health, breeding goals.

Vermi compost: Introduction, vermi composting material, species of earthworms, small scale, large scale composting process. Vermicompostings, harvesting, processing and drying. Nutrient content of vermi compost. Field application methods.

**UNIT -5-Biofertilizers**

(10h)

Introduction, status and scope. Structure and characteristic features of bacterial bio fertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*. Cyanobacterial biofertilizers- *Anabaena*, *Nostoc*, *Hapalosiphon* and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza. Mechanism of nitrogen fixation and phosphorus solubilization.

## Practical syllabus: Course 6B Organic farming

### III. Skilloutcomes:

On successful completion of the practical course, student shall be able to

1. Estimate NPK levels in the soil
2. Demonstrate the collection and processing of raw material
3. Develop skill of vermi compost production
4. Learn the technique of establishing organic farms
5. Equip with the skill of preparation of microbial media

### IV. Practical syllabus:

1. Collection of different soil samples
2. Qualitative estimation of nitrogen, phosphorus and potassium in soil samples
3. Collection of fruit, vegetable and other domestic waste
4. Preparation of compost beds and introducing earthworms
5. Collection of vermicastings
6. Sieving, drying and packing of vermicompost
7. Visit to animal shed and observing farm yard manure production
8. Preparation of media and isolation of biofertilizers

### V. References:

1. Principles of Organic Farming:: by E Somasundaram, D Udhaya Nandhini, M Meyyappan; 2021
2. Organic farming in India:: by Arpita Mukherjee; 2017
3. Biofertilizer and biocontrol agents for agriculture;; by AM Pirttilä · 2021
4. Trends in Organic Farming in India;; by S. S. Purohit, 2006
5. Biofertilizers for Sustainable Agriculture and Environment;; by Bhoopander Giri Ram Prasad, Qiang-Sheng Wu, Ajit Varma; 2019

### VI. Co-curricular activities:

a) **Mandatory:** (Training of students by teacher on field related skills; 15hrs)

1. **For teacher;** Training of students by teacher in laboratory and field for a total of 15hrs on soil sample collection, NPK analysis, collection of biodegradable waste, vermi composting, collection of castings, processing, drying & packing. In addition teacher should demonstrate the media preparation, sterilization, and isolation of microorganisms from soil.
2. **For students:** Visit to local organic farm, collection of earthworms, observing the crop growth raised in organic farms. Submission of field work report of 10 pages in the prescribed format.
3. Maximum marks for field work report: 05
4. Suggested format for field work report: Title page, student details, content page, introduction, work done, findings, conclusion and acknowledgements.
5. Unit test (IE)

b) **Suggested co-curricular activities:**

1. Comparing mineral content in different agricultural soil
2. Learning techniques of basic instruments handling related to fieldwork
3. Preparation of videos on compost preparation and application
4. Visit to local organic fields
5. Attending special lectures, group discussions and seminars on organic farming.

**VII. Suggested Question PaperPattern:**

Max.Marks: 75

Time: 3hrs.

**SECTIONA**

(Total: 15Marks)

Very Short Answer Questions (10 Marks: 5 x2)

**SECTIONB**

(Total: 5x5=25Marks)

(Answer any four questions. Each answer

carries 5 marks (At least 1 question should be

given from each Unit)

1.	
2.	
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**SECTION C (Total: 4x10 = 40 Marks)**

(Answer any four questions. Each answer

carries 10 marks (At least 1 question should be

given from each Unit)

1.	
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Suggested Question Paper Model for Practical  
Examination Semester – V/ Biotechnology Course – 6B  
(Skill Enhancement Course)

**Organic Farming**

Max. Time:3Hrs.

Max.

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Marks:50

- |   |             |
|---|-------------|
| 1. Estimate the pH of soil in given sample 'A'            | 8 M         |
| 2. Estimate the nitrogen content in given soil sample 'B' | 8 M         |
| 3. Perform streak plate technique for isolation 'C'       | 12 M        |
| 4. Scientific observation and data analysis               | 4 x 3 = 12M |
| A. Identify different earth worm species/photograph       |             |
| B. Sieving and processing of vermi compost -photograph    |             |
| C. VAM identification                                     |             |
| D. Farmyard manure  |             |
| 5. Record+Viva-voce                                       | 6+4 = 10M   |

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Semester-wise Revised Syllabus under CBCS, 2020-21

Four Year B.Sc.

Course Code:

Domain subject: Biotechnology

IV year B.Sc. -Semester-V

**Course 7B: Bio fertilizers and Bio pesticides production** (Skill enhancement course (Elective), 05 credits) Maximum Marks Theory: 100 + practical:50

**I. Learning outcomes:**

On successful completion of the practical course, student shall be able to

1. Understand the importance of bio fertilizers for sustainable agriculture.
2. Appreciate the role of VAM in P solubilisation
3. Define bio pesticide and its nature
4. Produce bio fertilizers and bio pesticides on large scale
5. Able to prepare inoculums for field application

**II. Syllabus:** (Total 90 hrs (including Teaching, Lab, Field Training and unit test setc.))

**UNIT -1-Biofertilizers** (10h)

Introduction, history, concept, scope of bio fertilizers in India. Classification, microorganisms used as bio fertilizers. Bacterial, fungal and algal bio fertilizers. Symbiotic and a symbiotic microorganisms. Mechanism of nodulation and nitrogen fixation.

**UNIT – 2- Mycorrhizal biofertilizers** (10h)

Importance, types, characteristic features of ecto and endomycorrhiza. Mechanism of phosphorus solubilisation. Uptake of phosphates by the roots. Consortium based inoculums and significance.

**UNIT-3 -Bio pesticides** (10h)

Definition, concept, history, scope and importance of bio pesticides.

Classification - botanicals, bacterial, fungal and viral based bio pesticides. Mechanism of action of *Bacillus thuringiensis* and *Trichoderma viridaeas* bio control agents.

**UNIT -4 - Mass production techniques** (10h)

Media, types, preparation. Methods of isolation, streak plate, spread plate and pour plate techniques, purification and identification of microorganisms used as bio fertilizers and bio pesticides. Mass production and packing techniques.

**UNIT- 5 - Field application methods** (10h)

Preparation of carrier based inoculum. Sphagnum, peat, vermiculite as inoculums carriers. Dosage standardisation. Seed treatment, foliar application, root dressing and soil application techniques. Storage and maintenance of inoculum.

**Practical syllabus: Course 7B Bio fertilizers and Bio pesticides Production**

**III. Skill outcomes:**

On successful completion of the practical course, student shall be able to

1. Prepare bacterial and fungal media
2. Isolate and identify symbiotic and free living nitrogen fixing bacteria
3. Isolate fungal bio control agents from soil samples.
4. Develop skill for large scale production of microorganisms

5. Learn field application techniques of biofertilizers and biopesticides

#### IV. Practical syllabus:

1. Preparation of Nutrient agar, YEMA, and PDA media
2. Isolation of *Rhizobium* from root nodules
3. Isolation of *Azotobacter* from soil samples
4. Isolation of *Trichoderma*
5. Gram staining of bacteria
6. VAM root staining
7. Raising of legume seedlings with *Rhizobium* treatment
8. Visit to commercial bio control units and Krishi Seva Kendra

#### V. References:

1. Biofertilizers: Commercial Production Technology and Quality Control, 2017 by Dr. P. Hyma
2. Biofertilizers Technology, 2010, by S. Kaniyan, K. Kumar and K. Govindarajan
3. Biofertilizers for Sustainable Agriculture, 2017; by Arun K. Sharma
4. Advances In Plant Biopesticides 2021, by Dwijendra Singh, Springer India
5. A Textbook of Integrated Pest Management, 2013 by Ram Singh & Vikas Jindal, G.S. Dhaliwal

#### VI. Co-curricular activities:

a) **Mandatory:** (Training of students by teacher on field related skills: 15 hrs)

1. **For teacher:** Training of students by teacher on preparation of different microbial media, isolation techniques – streak plate, spread plate, pour plate, Grams staining of bacteria, VAM and *Trichoderma* observation. Preparation of *Rhizobium* inoculum and application to legume seedlings.
2. **For students:** Raising of seedlings of Leguminaceae species, maintaining of the seedlings in nursery/green house. Comparing the growth of seedlings treated with biofertilizer and chemical fertilizer. Visit to Bio fertilizer and Bio pesticides commercial lab. Submission of field work report of 10 pages in the prescribed format.
3. Maximum marks for field work report: 05
4. Suggested format for field work book; Title page, student details, content page, introduction, work done, findings, conclusion and acknowledgements.
5. Unit test (IE).

#### b) Suggested co-curricular activities;

1. Training of students by the industrial experts
2. Identification and collection of botanical pesticides
3. Assignments/seminars/group discussion /quiz on bio fertilizers and biopesticides
4. Preparation of videos, charts on inoculum development and field application
5. Attending invited guest lectures on the concerned topics

**VII. Suggested Question PaperPattern:**

Max.Marks: 75

Time: 3hrs.  
(Total: 15Marks)

**SECTIONA**

Very Short Answer Questions (10 Marks: 5 x2)

**SECTIONB**

(Total: 5x5=25Marks)

(Answer any four questions. Each answer

carries 5 marks (At least 1 question should be

given from each Unit)

1.	
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**SECTION C (Total: 4x10 = 40 Marks)**

(Answer any four questions. Each answer

carries 10 marks (At least 1 question should be

given from each Unit)

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Suggested Question Paper Model for Practical Examination  
Semester – V/ Biotechnology **Course – 7B** (Skill Enhancement Course)

**Bio fertilizers and Bio pesticides Production**

Max. Time:3 Hrs.

Max. Marks: 50

1. Identify the given microbial sample based on morphological characteristics 'A' 8 M
2. Identify the given culture based on microscopic observation 'B' 8 M
3. Perform the section cutting of root nodule 'C' 12 M
  
4. Scientific observation and data analysis 4 x 3 = 12M
  - A. Identify the given algal fertilizer/photograph
  - B. Identify the fungal bio fertilizer -photograph
  - C. VAM identification
  - D. Seed treatment
  
5. Record+Viva-voce 6+4 = 10M

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Semester-wise Revised Syllabus under CBCS,2020-21

Four-year B.Sc.

Course Code:

Domain Subject: BIOTECHNOLOGY

IV year B. Sc. – Semester – V

**Course 6C Apiculture**

(Skill Enhancement Course (Elective), 05 Credits)

Max Marks: Theory:100 + Practical:50

**I. Learning outcomes**

Students after successful completion of the course will be able to

1. Understand the basic concepts of Apiculture.
2. Obtain the elementary knowledge of different species and races of honeybees
3. Appreciate the importance of health and hygiene in Beekeeping
4. Maintain the Bee hives in a scientific way

**II. Syllabus:** (Total Hours: 90 including Teaching, Lab, Field Training and unit test setc.)

**Unit 1: Biology of Bees**

**10 hrs**

History, Classification and Life Cycle of Honey Bees. Social Organization of Bee Colony.

**Unit 2: Rearing of Bees**

**10 hrs**

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth. Methods of Extraction of Honey (Indigenous and Modern).

**Unit 3: Diseases and Enemies**

**10 hrs**

Bee Diseases and Enemies. Control and Preventive measures.

**Unit 4: Economy and Entrepreneurship**

**10 hrs**

Products of Apiculture Industry and its Uses (Honey, Bee Wax, Propolis) and Pollen.

**Unit 5: Entrepreneurship in Apiculture**

**10 hrs**

Bee Keeping Industry: Present and future, Role of Bees in cross pollination in horticulture and agriculture. Prospects of apiculture as self-employment venture.

**Practical Syllabus: Course 6C Apiculture**

**III. Skills Outcomes:**

On successful completion of this practical course, student shall be able to:

1. Maintain the Bee hives in a scientific way.
2. Clean & Maintain Bee Boxes
3. Use of other tools required in Bee Keeping
4. Building and division of colony
5. Understand the methodologies of extracting, preservation and marketing of honey and other products of honeybee

**IV. Practical syllabus**

1. Handling of tools and techniques for Apiculture
2. To study the morphological and anatomical characteristics of queen and worker bees
3. Identification of different species of honeybees
4. Preparation of honey bee trays for beekeeping, maintenance and colony inspection
5. Extraction of honey and beeswax

6. Processing of honey, packing and storing
7. Identification of honey adulteration

#### V. References:

1. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
2. Graham, J M (1992) The hive and the honey bee. Dadant and Sons, Hamilton, Illinois.
3. Mishra R.C. (1995) Honey bees and their management in India. ICAR Publication New Delhi.
4. Singh, S. (1971) Beekeeping in India, ICAR publication..
5. Bisht, D.S. (2004). Agricultural Development in India, Anmol Pub. Pvt.Ltd.
6. Singh S.(1964). Beekeeping in India, Indian council of Agricultural Research, New Delhi
7. Mehrotra, K.N. Bisht, D.S. (1981). Twenty-five years of apiculture research at IARI. Apiculture in relation to agriculture.

#### VI. Co-Curricular Activities

##### a) **Mandatory:** (*Training of students by teacher on field related skills: 15hrs*)

1. For Teacher: Training of students by teacher in laboratory and field for a total of 15 hours in Preparation of honey bee trays for beekeeping, maintenance and colony inspection. Extraction, processing, packing and storing of honey and beeswax
2. For Student: Individual visit to an Apiculture facility or related field or to a laboratory in a university/research organization/private sector and study of Apiculture practices. Submission of a hand-written Fieldwork Report not exceeding 10 pages in the given format.
3. Max marks for Field Work Report: 05.
4. Suggested Format for Field work: Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.
5. Unit tests (IE).

##### b) **Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments (including technical assignments like Identification of flora and location of site, procurement of bee box and other tools, building & division of comb and colony, manage insects and diseases and nuisance in bee hives, knowledge of the scientific methods of beekeeping)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques on beekeeping.
5. Collection of material/figures/photos related to products of Apiculture, writing and organizing them in a systematic way in a file.
6. Visits to Apiculture facilities, firms, research organizations etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

**VII. Suggested Question PaperPattern:**

Max.Marks: 75

Time: 3hrs

SECTIONA (Total: 15 Marks)

Very Short Answer Questions (10 Marks:: 5x2)

SECTIONB

(Total: 5x5=25Marks)

(Answer any four questions. Each answer

carries 5 marks (At least 1 question should be

given from each Unit)

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SECTIONC

(Total: 4x10 = 40Marks)

(Answer any four questions. Each answer carries

10 marks (At least 1 question should be given

from each Unit)

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## Suggested Question Paper Model for Practical Examination

Semester – V/ Biotechnology Course – 6C (Skill Enhancement Course)

### Apiculture

Max. Time:3 Hrs.

Max. Marks: 50

1. Identification of different species of honeybees‘A’ 8 M
2. Demonstration of use of different boxes and other tools in BeeKeeping‘B’ 8 M
3. Methods of harvesting, processing and preservation of honey‘C’ 12 M
4. Scientific observation and data analysis 4 x 3 = 12M
  - A. Identify tools for Apiculture/photograph
  - B. Identification of morphological and anatomical characteristics of queen and worker bees/ photograph
  - C. Identify Common pests that attack honey bees and hives /photograph
  - D. Building of comb and colony/photograph
5. Record+Viva-voce 6+4 = 10M

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Semester-wise Revised Syllabus under CBCS, 2020-21

Four-year B.Sc.

Course Code:

Domain

Subject: BIOTECHNOLOGY IV  
year B. Sc., – Semester – V Course

**7C Pearl Culture**

(Skill Enhancement Course (Elective), 05 Credits)

Max Marks: Theory: 100 + Practical: 50

**I. Learning outcomes**

Students after successful completion of the course will be able to

1. Understand the basic concept of pearl culture.
2. Obtain the elementary knowledge regarding the Anatomical and Physiological aspects of fresh water oysters.
3. Acquaint with the various types of implantation methods and pearl culture surgery techniques.
4. Acquire skill on production of pearl and its marketing for economic gain

**II. Syllabus:** (Total Hours: 90 including Teaching, Lab, Field Training and unit test setc.)

**Unit 1: Overview of Pearl oyster**

(10h)

Biology of Pearl oyster: Pearl producing molluscs. Morphology and anatomy of Pearl oyster, Life cycle of pearl oyster.

**Unit 2: Process of Pearl formation**

(10h)

Structure and Histology of mantle. Natural Process of Pearl formation. Chemical composition of Pearls. Economic importance of pearls.

**Unit 3: Pearl oyster culture**

(10h)

**Pearl oyster culture** Techniques of pearl oyster culture (Fresh water and Marine water) for artificial production of pearls. Pearl culture techniques -Rafts, long lines, Pearls oyster baskets, under water platforms, mother oyster culture/Collection of oysters, rearing of oysters, Environmental parameters.

**Unit 4: Pearl Oyster surgery**

(10h)

Selection of Oyster, Graft tissue preparation, Nucleus insertion, Conditioning for surgery, Post-operative culture, harvesting of pearl, clearing of pearl.

**Unit 5: Pearl culture Economy**

(10h)

Diseases and Predators of Pearl oysters' Present status, prospects and problems of pearl industry in India.

**Practical Syllabus: Course 7C Pearl Culture**

**III. Skills Outcomes:**

On successful completion of this practical course, student shall be able to:

1. Execute pre- pearl culture activities
2. **Learn the technique of surgical operation**
3. **Develop skill of Post operation activities**
4. Implement culture activities
5. Perform pearl harvesting

#### IV. Practical syllabus

1. Technique for measurement of soil and water
2. Culture technique of microorganism for pond maintenance. Surgical techniques
3. Graft tissue preparation, implantation techniques, post operation care
4. Designed pearl culture techniques, bleaching, collection of pearls, cleaning of pearls
5. Sorting of pearls, marketing of pearls.

#### V. References:

1. Haws Maria (2002). The basics of pearl farming: a Layman's manual: (U.S.A). CTSA publications.
2. Alexander E .Farn (1986) pearls :(U.S.A.).Butterworth Heinemann publications.
3. Le JiaLi (2014) new technologies to promote freshwater pearl culture (China) Ocean Press publications.
4. Bardach, J.E.W (1972) Aquaculture farming and husbandry of freshwater and Sorting of Pearl. Marketing and economics concerned with Pearl Culture. Generation marine organisms
5. David Dobilet (1995) Pearl farming (Australia) Nat Geographic Mag publication
6. Yuan Cha Da (2014) Environmental effects Pearl farming (China) Jiangxi People publishing house.

#### VI. Co-Curricular Activities

##### a) **Mandatory:** (*Training of students by teacher on field related skills: 15hrs*)

1. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15hours on construction of pearl farm, collecting oysters, seeding, caring the oyster and harvesting
2. **For Student:** Individual visit to a pearl culture facility or related field or to a laboratory in a university/research organization/private sector and study of pearl culture practices. Submission of a hand-written Fieldwork Report not exceeding 10 pages in the given format.
3. Max marks for Field Work Report:05.
4. Suggested Format for Field work: Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.
5. Unit tests(IE).

##### b) **Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments (including technical assignments like identifying tools in pearl culture and their handling, operational techniques with safety and security, IPR)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques in pearl culture.
5. Collection of material/figures/photos related to products of pearl culture, writing and organizing them in a systematic way in a file.
6. Visits to pearl culture facilities, firms, research organizations etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

**VII. Suggested Question Paper Pattern:**

Max.Marks: 75

Time: 3hrs

SECTIONA (Total: 15Marks)

Very Short Answer Questions (10 Marks : 5 x2)

SECTIONB

(Total:

5x5=25 Marks) (Answer any four questions. Each answer carries 5marks

(At least 1 question should be given from each Unit)

1.	
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SECTIONC

(Total: 4x10 =

40 Marks) (Answer any four questions. Each answer carries 10marks

(At least 1 question should be given from each Unit)

1.	
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**Suggested Question Paper Model for Practical**  
**Examination Semester – V/ Biotechnology Course – 7C**  
**(Skill Enhancement Course) Pearl Culture**

Max. Time:3 Hrs.

Max.

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Marks: 50

- |  |             |
|--|-------------|
| 1. Identify pearl producing oyster, preparation of nuclei 'A'      | 8 M         |
| 2. Prepare graft tissue, perform surgical implantations. 'B'       | 8 M         |
| 3. Implantation of live graft pieces into the mantle of mussel 'C' | 12 M        |
| 4. Scientific observation and data analysis                        | 4 x 3 = 12M |
| A. Pearl culture surgical instruments/photograph                   |             |
| B. Identification of Pearl/ photograph                             |             |
| C. Classification of pearls /photograph                            |             |
| D. Biomineralisation of pearls/photograph                          |             |
| 5. Record+Viva-voce  | 6+4 = 10M   |

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## HOD profile



### 1. Personal details:

- a. Name of the Faculty :** M. NAGA JAYA SUDHA
- b. Department :** BIO-TECHNOLOGY
- c. Designation :** Asst.Professor (Selection Grade)
- d. Subjects Taught :** Bio-Technology at Graduate level
- e. Level of Guidance & Teaching :-**
- f. Qualification: M.Sc., (P.hD)**
- g. Teaching Experience :** Graduate level - 8 years,

### Academic Degrees:

Degree	University/Board	Date/Year	Awarded/ Grade/Class
P.hD.,	GITAM University, Visakhapatnam.	2020	Pursuing
M.Sc. (Bio-Tech)	REVA College, Bangalore University.	2006	First Class
B.Sc., (Bio-Tech)	Sri Vani Degree College, Anantapur. S.K Univeristy	2004	First Class
Intermediate	BIE, Andhra Pradesh	2000	First Class
S.S.C.	Board of Secondary School Education, AP	1998	First Class

### Faculty profile

Name	Qualification	Designation	Teaching Experience

**Student profile Program wise:**

Name of the course	Year	Total Seats	Enrolled	total
<b>BMC</b>				

**Infrastructure facilities:**

**Library:** There is a central library to cater to the need of the students. Department does not have a library. But the complimentary copies provided by different publisher are provided in the department for the use of the student.

**Internet facility for staff and students:** Yes (only for staff )

Classroom with ICT facility:

Yes Laboratories: Yes. Department has one single lab

**DEPARTMENT OF BIO-TECHNOLOGY**



























