।। सा विद्या या विमुक्तये ।।

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

"ज्ञानतीर्थ" परिसर, विष्णुपूरी, नांदेड - ४३१६०६ (महाराष्ट्र)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)

Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade

ACADEMIC (1-BOARD OF STUDIES) SECTION

Phone: (02462) 229542
Fax : (02462) 229574

Website: www.srtmun.ac.in

E-mail: bos.srtmun@gmail.com

प्रस्तुत विद्यापीठाच्या न्यु मॉडल डिग्री कॉलेज हिंगोली येथील विज्ञान व तंत्रज्ञान विद्याशाखेतील B. Sc. Biotechnology III year पदवी स्तरावरील CBCS Pattern नुसारचा अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, प्रस्तुत विद्यापीठाच्या न्यु मॉडल डिग्री कॉलेज हिंगोली येथील **विज्ञान व तंत्रज्ञान विद्याशाखेतील B. Sc. Biotechnology III year या पदवी स्तरावरील C.B.C.S. (Choice Based Credit System) Pattern** नुसारचा अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करण्याच्या दृष्टीन मा. कुलगुरू महोदयांनी मा. विद्यापरिषदेच्या मान्यतेच्या अधीन राहून अभ्यासक्रमास मान्यता दिलेली आहे.

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शैक्षणिक–१/परिपत्रक/पदवी–सीबीसीएस अभ्यासक्रम/
न्यू मॉडल डिग्री कालेज/ २०२१–२२/**१०५**
दिनांक : १०.०८.२०२१.

स्वाक्षरित
सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :
१) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) प्राचार्य, न्यु मॉडल डिग्री कॉलेज हिंगोली, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.
७) अधीक्षक, परिक्षा विभाग विज्ञान व तंत्रज्ञान विद्याशाखा प्रस्तुत विद्यापीठ.

Swami Ramanand Teerth Marathwada University Nanded's

New Model Degree College, Hingoli

B.Sc. Biotechnology (CBCS), III -Year

Syllabus effective from 2021-22 onwards

Salient Features:

The contextual curriculum constructed for B.Sc. Biotechnology Third year is related to the projected educational objectives of higher education and the Tyagrajan committee constituted for Model colleges throughout India. During designing the curriculum care has been taken to understand the difficulties and needs of students of all sections of the society and from educationally backward areas are considered for enhancing employability and maximizing opportunities for further education and to serve the need of learner centric Choice Based Credit System (CBCS). The course structure to orient and practically train students in the field of Biotechnology. During developing curricula, the entire Third year curriculum is divided into two streams namely Major Curriculum and Life Skill Curriculum weighted in the ratio 22:8. The major curriculum is divided as Major core, Supportive and Innovative curriculum. Under this Basic and Applied Enzymology, Computational Biology and Bioinformatics, Seminar, Field Visit are major core; Dairy and Food Biotechnology is supportive and Lab Course-5 and Lab Course-6 are applied curriculum for Fifth semester. Whereas Pharmaceutical Biotechnology, Genetic Engineering, Field Visit and seminar are major core; plant tissue culture technique are supportive and Lab Course-7 and Combined Project are applied curriculum for Sixth semester. The Life-Skill Curriculum is categorized into Job Oriented and Value Oriented curriculum. Painting & Graphics, Sculpture and Applied Art are value-oriented courses; Microbial Technology and Bioprocessing is job oriented curriculum for Fifth semester whereas Hindustani Music, Instrumental and Vocal Music and Rabindra Sangit are value oriented courses and Mushroom Production Technology is job oriented curriculum for Sixth semester.

Utility:

The curriculum of B. Sc. Third year Biotechnology course will train the students in the field of Enzymology, Pharmaceuticals, Animal cell culture, Dairy and food Science, Bioinformatics and genetic. The courses in Value oriented Skills will present and cultivate practical knowledge and skills in painting and music. The job oriented curriculum will fulfil the local needs of farmers and industries in our country.

Learning Objectives:

1. To pass on knowledge of basic and applied biotechnology.
2. To design the curriculum that enable students to prepare for JAM and other competitive examinations of M.Sc. admission and other competitive examinations successfully.
3. To make the students aware of Indian culture, folks and history.
4. To brought balance between highly instrumentalized, market driven soft-skills and a value oriented and general life enhancing skills.

Prerequisites:

The course is offered for a student registered for undergraduate programme in the faculty of Science and Technology who had primary knowledge and training in the field of basic biological, chemical, mathematical and physical sciences and interested to gain additional advanced knowledge in the field of biotechnology.

Swami Ramanand Teerth Marathwada University Nanded's
New Model Degree College, Hingoli
B.Sc. Biotechnology (CBCS)
III -Year, V -Semester
Syllabus effective from 2021-22 onwards

Course Code	Course Title	Credits	Total Credits
BBT 5-IIA-A Major (Core)	**Basic and Applied Enzymology**	**04**	**30**
BBT 5-IIA-B Major (Core)	**Computational Biology and Bioinformatics**	**04**	
BBT 5-IIB Major (Supportive)	**Dairy and Food Biotechnology**	**04**	
BBT 5-IIC-A Major (Innovative)	**Lab Course-5** **(**Based on BBT 5-IIA-A & BBT 5-IIA-B)	**04**	
BBT 5-IIC-B Major (Innovative	**Lab Course-6** **(**Based on BBT 5-IIB & BBT 5-IIIA)	**04**	
BBT 5-IIIA Job Oriented Life Skills	**Microbial Technology and Bioprocessing**	**04**	
BBT 5-III B Value Oriented Life Skills	**Electives:** **1.Painting and Graphics** **2. Sculpture** **3. Applied Art**	**04**	
BBT 5-IIA-C Major (Core)	**Seminar**	**01**	
BBT 5-IIA-D Major (Core)	**Field Visit**	**01**	

Note:
1. Code BBT 5-IIA-A, BBT 5-IIA-B, BBT 5-IIA-C, BBT 5-IIA-D, BBT5-IIB, BBT5-IIC-A, BBT5-IIC-B, are Major Curriculums.
3. BBT5-IIIA, BBT5-III B are Life Skill Curriculums.

Swami Ramanand Teerth Marathwada University Nanded's
New Model Degree college, Hingoli
B.Sc. Biotechnology (CBCS)
III -Year, VI -Semester
Syllabus effective from 2021-22 onwards

Course Code	Course Title	Credits	Total Credits
BBT 6-IIA-A Major (Core)	**Pharmaceutical Biotechnology**	04	**30**
BBT 6-IIA-B Major (Core)	**Genetic Engineering**	04	
BBT 6-IIB Major (Supportive)	**Animal Cell Culture Techniques**	04	
BBT 6-IIC-A Major (Innovative)	**Lab Course-7** **(**Based on BBT 6-IIA-A , BBT 6-IIA-B BBT 6-IIB)	04	
BBT 6-IIC-B Major (Innovative)	**Combined Project**	04	
BBT 6-IIIA Job Oriented Life Skills	**Mushroom Production Technology**	04	
BBT 6-III B Value Oriented Life Skills	**Electives:** **1. Hindustani Music** **2. Instrumental and Vocal Music** 3. **Rabindra Sangit**	04	
BBT6-IIA-C Major (Core)	Seminar	01	
BBT 6-IIA-D Major (Core)	Field Visit	01	

Note:
1. Code BBT 6-IIA-A, BBT 6-IIA-B, BBT 6-IIA-C, BBT 6-IIA-D, BBT6-IIB, BBT6-IIC-A and BBT 6-IIC-B are Major Curriculums.
3. BBT6-IIIA, BBT6-III B are Life Skill Curriculums.

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

V Semester (Major Curriculum)

BBT 5 – IIA-A: Basic and Applied Enzymology (Major Core)

Marks: Internal 50 + External 50 Total Periods:45

Unit-I: Basic concepts in Enzymology **07 Periods**

1.1 Defination and terms involved in enzymology
1.2 Brief History of enzymology
1.3 Nomenclature and Classification of enzymes
1.4 Enzyme specificity
- i. Types of specificity
- ii. Active site
- iii. Hypothesis of specificiy
- iv. Strain and transition state stabilisation

1.5 Monomeric and oligomeric enzymes
1.6 Factors affecting enzymatic catalysis.

Unit-II: Kinetics of enzyme catalysed reactions **9 Period**

2.1 Historical Introduction to enzyme kinetics
2.2 Methods used for kinetic study investigation
2.3 Kinetics of single suubdtrate enzyme catalysed reaction
- i. Michaelis-Menten equation and its signnificance
- ii. Briggs-Haldane Modification
- iii. Lineweaver-Burk plot
- iv. Eadie-Hofstee and Hanes plot
- v. Eisenthal and Cornish-Bowden plot

2.4 Mechanism of multiezyme catalysed reaction
2.5 Hill plot.

Unit-III: Enzyme catalysis and Enzyme Inhibition **11 Periods**

3.1 Mechanism of catalysis
3.2 Reaction catalysed by enzyme without cofactor
3.3 Metal activators and Metalloenzymes
3.4 Role of Coenzymes
3.5 Reversible inhibition
- i. Competative inhibition
- ii. Uncompetative inhibition
- iii. Non-competative inhibition
- iv Mixed inhibition
- v Substrate inhibition
- vi Allosteric inhibition

3.6 Irrevesible inhhibition

Unit-IV: Biosynthesis,Extraction and Purification of enzymes **09 Periods**

4.1 Microbial Biosyntheis of Amylase,Protease and Lipases
4.2 Extraction of soluble and membrane bound enzyme
4.3 Purification of enzymes
4.4 Criteria of Purity
4.5 Synzyme, Ribozymes and abzymes

Unit-V: Applications of enzymes **09 Periods**

5.1 Applications of enzymes in Medicine and Industry
5.2 Enzyme immobilisation and its application
5.3 Design of some immobilized enzyme bioreactors
5.4 Enzyme as Biosensor: Principle,instrumentation,types and application
5.5 Enzyme Stabilization and Engineering
5.6 Some important industries in the field of Enzymology

References:

1. Enzymes :Biochemistry,Biotechnology and Clinical chemistry 2nd Edition, Trevor Palmer and Phillip Bonner;Horwood publishing limited
2. Biocatalysts and Enzyme Technology by Klaus Buchholz, Volker Kasche, and Uwe Theo Bornscheuer
3. Enzyme Technology (Biotechnology Series) by P. Gacesa and J. Hubble
4. Methods in Enzymology. Volume 22 Enzyme purification and related techniques. Edited by William B. Jakoby. Academic Press, New York.
5. Allosteric Enzymes - Kinetic Behaviour. 1982. by B.I. Kurganov. John Wiley and Sons. Inc., New York.
6. Biotechnology. Volume 7 A -Enzymes in Biotechnology. 1983 Edited by H. J. Rehm and G. Reed. Verlag Chemie.
7. Hand Book of Enzyme Biotechnology by Wiseman.
8. Enzymes as Drugs Edited by John S. Holcenberg and Joseph Roberts , John Wiley & Sons New York.
9. Methods of Enzymatic Analysis by Hans Ulrich, Bergmeyer, Academic Press.
10. Methods in Enzymology by W.A. Wood, Academic Press.
11. Advances in Enzymology by Alton Meister, Interscience Publishers.
12. Topics in Enzyme and Fermentation Biotechnology by L.N. Wiseman, John Wiley and Sons

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

V Semester (Major Curriculum)

BBT 5 – IIA-B Computational Biology and Bioinformatics (Major Core**)**

Marks: Internal 50 + External 50 Total Periods:45

Unit I: Introduction to Bioinformatics **Period: 07**

1.1 Concept and scope of bioinformatics and computer
1.2 Brief History of Information Technology and Computer Science
1.3 Essential tasks of Bioinformatics analysis
1.4 Data types in molecular biology
1.5 Biological databases Concepts and Types

Unit II: Sequence Alignments **Period: 11**

2.1 Single Sequence alignments
2.2 Similarity and Homology
2.3 Dynamic Programming in sequence alignment
2.4 FASTA and BLAST,
2.5 Scoring matrix,PAM, BLOSUM,gap penalty
2.6 Multiple sequence alignments
2.7 Theory of scoring matrices and their use for sequence comparison.

Unit III: Evolutionary Analysis **Period: 10**

3.1 Phylogenetics, Cladistics, Clustering Methods,
3.2 Rooted and unrooted tree presentation,
3.3 PHYLIP, Clustal X, DAMBE,
3.4 Use of sequences to determine phylogenetic relationship.
3.5 Distance Matrix methods- UPGMA and Neighbour joining
3.6 Maximum Parsimony and Maximum likelihood

Unit IV: Protein and DNA sequence analysis and structure determination **Period: 09**

4.1 Conceptual Models of Protein structure, Evolution of protein structure and function
4.2 Pattern representation and characterization
4.3 Pattern discovery and sequence classification in proteins
4.4 Sequence classification in Nucleic acids
4.5 CATH and SCOP
4.6 genome annotation

Unit V: Applications of Bioinformatics **Period: 08**

5.1 Proteomic data analysis, cheminformatics,
5.2 Drug Discovery, HGP,
5.3 Microarray data analysis, genome maps
5.4 Protein structure prediction

5.5 RNA strucureprediction
5.6 DNA structural polymorphism

References,

1. N Gautham (2007), Bioinformatics: Database and algorithms , Narosa Publishing House New Dehli,India
2. Gautam B Singh (2014); Fundamentals of Bioinformatics and Computational Biology
3. Rastogi S.C., Mendiratta N. and Rastogi P. (2004) *Bioinformatics Concepts Skills and Applications.* CBS Publishers and Distributors, India.
4. Mount D.W. (2005) *Bioinformatics Sequence and Genome Analysis.* CBS Publishers and Distributors, India.
5. Higgins D. and Taylor W. (2003) *Bioinformatics Sequences Structures and Data Banks.* Oxford University Press, UK.
6. Westhead D.R., Parish J.H., Twaman R.M. (2002) *Instant notes in bioinformatics.* CB Publishers and Distributors, India.
7. William T Loging (2016); Bioinformatics and Computational Biology in Drug Discovery
8. Wing-Kin Sung (2009); Algorithms in Bioinformatics: A practical Introduction

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

V Semester (Major Curriculum)

BBT 5 – II B: Dairy and Food Biotechnology (Major Supportive)

Marks: Internal 50 + External 50 **Total Periods: 45**

Unit-I: Introduction to Food and Dairy Biotechnology **Period: 9**

1.1 Introduction, world food requirement, aims of food biotechnology, interdisciplinary approach, constituents of food,

1.2 Impact of biotechnology on the nutritional quality of foods
1.3 Milk: Composition and Types
1.4 Physico-chemical properties of Milk
1.5 Nutritive value of Milk
1.6 Chemistry of Milk proteins and lipids
1.7 Fermented Products of Milk: Butter, Yoghurt and Cheese
1.8 Types of Microbes in milk
1.9 Microbiological examinations of Milk

UNIT II: Food Microbiology **Period: 6**

2.1 Primary Sources of Microorganisms in food.
2.2 Food borne Bacteria, Molds and Yeasts.
2.3 Intrinsic and Extrinsic Parameters of food affecting microbial count.
2.4 Detection of Microorganisms in food: SPC, Membrane filters, Dry films.
2.5 Bacterial Toxin: Botulism and Staphylococcal toxin.
2.6 Fungal Toxins: Aflatoxin.

UNIT III: Food Safety and Quality. **Period: 8**

3.1 Food Hygiene – Food-borne Infections & Intoxications, Microbial Toxins, Indicator Organisms.
3.2 Industrial Plant Sanitation and Hygiene.
3.3 Quality Control & Assurance – GMP, GHP, GLP, GAP, HACCP; Indian and International Quality Systems and Standards (BIS, ISO, Codex Alimentarius, Codex India, etc.)
3.4 Food Quality Analysis
  a. Food Sampling Techniques
  b. Separation Techniques
  c. Analytical Techniques
3.5 Biosensors for food quality assessment
3.6 Natural Colors: Types, Applications, Advantages of natural colours.
3.7 Sweeteners: Types and Applications.

UNIT IV: Food Spoilage and Preservation. **Period: 11**

4.1 Causes of Food Spoilage.
4.2 Common food borne pathogens
4.3 Food Borne Disease outbreaks
4.4 Food Preservation through chemicals
4.5 Other Methods of Food Preservation

Unit-V: Emerging Food Biotechnologies **Period: 11**

5.1 Biotechnological approaches to improve nutritional quality and shelf life of fruits and vegetables
5.2 Biotransformation applicable to food industries
5.3 Industrial food waste management
5.4 Functional foods: Concept of Prebiotics, Probiotics and Neutraceuticals
5.5 Biotechnology of β-carotene from *Dunaliella*
5.6 SCP: *Spirulina* and *Chlorella*

References :

1) Adam M.R and Moss M.O (2003), Food Microbiology, New Age International Pub.New Delhi.
2) Frazier W.C and Westhoff D.C (2005), Food Microbiology,4th Edi.,Tata Mc Graw Hill Pub Company Ltd.New Delhi.
3) Harrigan W. F (1998), Laboratory methods in Food Microbiology, 3rd Edi. Academic Press. New York.
4) Jay J.M. (1992), Modern Food Microbiology, 4th Ed. Chapman and Hall, New York, NY, USA.
5) K. Vijaya Ramesh (2007), Food Microbiology Publishers, Chennai.
6) Power C.B and Daginawala H.F(2003), General Microbiology, Vol. II, Himalaya Pub.House, Mumbai.
7) Sivsankar B (2002), Food Processing and Preservation, Prentice Hall of India Pvt. Ltd. New Delhi.

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

V Semester (Major Curriculum)

BBT 5-IIC-A Lab Course-5 (Major Innovative)
(Based on BBT 5-IIA-A & BBT 5-IIA-B)

Marks: Internal 50 + External 50 **Total Periods: 45**

---

1. Introduction to techniques and Units in enzymology
2. Amylase assay (Salivary/Bacterial/Fungal)
3. Time course measurement in enzymatic reaction
4. Effect of substrate concentration on the rate of enzymatic reaction
5. Effect of pH and temperature on the rate of enzyme reaction
6. Inhibition of enzyme activity and deter of Ki values
7. Immobilization of enzymes with sodium alginate
   A. Preparation of urease/Amylase entrapped in alginate beads and determination of percent entrapment
   B. Study of the kinetics of the rate of Starch hydrolysis by Amylase entrapped alginate beads
8. Data mining
9. Retrieval of sequences using ENTREZ
10. Sequence analysis using BLAT, Align,
11. Multiple sequence alignment and Phylogenetic analyzing using Clustal, ClustalW
12. study of primary structure of protein
13. study of secondary structure of protein
14. Studying 3D structure using RASMOL
15. Homology Modeling using Swiss PDB – Hb, Protease
16. Designing primer for given DNA sequence using online tool
17. Study of Ramachandran plot using online tool

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

V Semester (Major Curriculum)

BBT 5-IIC-B Lab Course-6 (Major Innovative)
(Based on BBT 5-IIB & BBT5-IIIA)

Marks: Internal 50 + External 50 **Total Periods: 45**

---

1. Isolation and Characterization of food fermenting organism from idli batter.
2. Estimation of ascorbic acid from given food sample by titrimetric method.
3. Analysis of mycotoxin (Aflatoxin) in fungus contaminated food material.
4. Microscopic examination of Food/Milk by breed method.
5. Estimation of lactose from milk.
6. Quality characterization of pasteurized milk by MBRT method.
7. To judge efficiency of pasteurization of milk by Phosphatase test.
8. Detection of microbial count in Milk by SPC method.
9. Isolation and biochemical testing of probiotic cultures (Lactobacilli) from food samples (curd, and dosa)
10. Check the potential of bacterial culture as probiotic culture by testing bile
    i) salt tolerance ii) acid tolerance iii) heat tolerance
11. Isolation of industrially important microorganisms for microbial processes (citric / lactic) and improvement of strain for increase yield by mutation
12. Microbial production of Citric acid, Lactic acid, alcohol.
13. Microbial production of Antibiotics Penicillin, Streptomycin, rifamycin etc
14. Bioleaching of copper.
15. Production of Microbial Insecticide

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

V Semester (Life Skill Curriculum)

BBT 5 – IIIA Microbial Technology and Bioprocessing (Job Oriented Life Skills**)**

Marks: Internal 50 + External 50 **Total Periods: 45**

Unit-I-Introduction to Microbial technology **Period: 07**

1.1 Biotechnology & Bioprocess Engineering
1.2 Steps in bioprocess development
1.3 Basic terms and applications of microbial technology
1.4 Batch culture with Kinetics
1.5 Continuous culture with kinetics
1.6 Feed batch system with examples

Unit-II-Industrial microbial culture and strain improvement **Period: 09**

2.1 Criteria and methods of isolation
2.2 Enrichment culture
2.3 Aseptic method of inoculation
2.4 Fermentation Material and Energy balance
2.5 Maintenance and Preservation of culture
2.6 Applications of r-DNA technique in strain improvement
2.7 Development of inoculums

Unit-III-Upstream processing **Period: 07**

3.1 Fermentation Medium
3.2. Design and construction of fermenter
3.3 Process parameters and measurement techniques
3.4 Types of fermenter
3.5 Heat and Mass transfer in Bioprocess
3.6 Aeration and agitation
3.7 Scale up and Scale down

Unit-IV-Downstream Processing **Period: 9**

4.1 Methods for extraction of products
4.2 Removal of microbial cells, foam and other debris
4.3 Filtration and centrifugation
4.4 Cell Disintegration
4.5 Liquid liquid Extraction
4.6 Chromatographic Techniques

Unit-V- Industrially important microbial products **Period: 13**

5.1 Organic acid (Citric acid)
5.2 Amino Acid (Lysine, glutamic acid)
5.3 Solvents (acetone-butanol)
5.4 Antibiotics (Penicillin and Tetracycline)
5.5 Microbes as biopesticide and biofertilizers
5.6 Effluent treatment. Analysis of the final industrial products .

References:

1. Stanbury, P. F., Whitaker and Hall, A. S. J., Principles of Fermentation Technology. Butterworth-Heinemann
2. Shuler, M.L. and Karg, I F., Bioprocess Engineering Basic Concepts , Prentice Hall.
3. Vogel, H.C. Todaro, C.L. and Todaro C.C., Fermentation and Biochemical Engineering Handbook: Principles, Process Design, and Equipment, Noyes Data Corporation/ Noyes Publications.

.

4. Crueger W. and Crueger, A., Biotechnology. A Textbook of Industrial Microbiology, Sinauer Associates.
5 Reed, G., Prescott and Dunn's Industrial Microbiology, AVI publication
6. Casida L. E. J. R., Industrial Microbiology, New Age (1968)
7. Pandey A, Lasroche C, Soccol C. R and Dussop C. G. Advances in Fermentation technology (2008). Asiatech publishers Inc.
8. Principles of Fermentation Technology by P. F. Stanbury, A. Whitaker, S. J. Hall. Publisher: Butterworth-Heinemann
9. Biochemical Engineering by S. Aiba, A.E. Humphrey and N.F. Millis. Publisher: University of Tokyo Press.
10. Bioreaction Engineering Principles by J. Nielson and J. Villadsen Publisher: Plenum Press

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

V Semester (Life Skill Curriculum)

BBT 5 - IIIB Painting and Graphics (Value Oriented Life Skills**)**

Marks: External 50 + Internal 50 **Total Periods: 45**

Unit- 1: Introduction to painting and graphics **08 Periods**

1.1 Six limbs of Indian painting
1.2 Fundamentals of visual arts
1.3 Elements and principles of painting
1.4 Drawing and painting materials
1.5 Media of composition
1.6 Graphics: linocut, etching, Lithography and screen painting

Unit- 2: History of Indian Art **10 Periods**

2.1 Pre Historic rock Paintings
2.2 Study of Sculpture and Terra Cottas
2.3 Study of seal:
2.4 Budhist Jain and Hindu art
2.5 Introduction to Ajanta paintings
2.6 Temple Sculpture, Bronzes and artistic aspects of Indo-Islamic Architecture

Unit- 3: Introduction to painting schools **06 Periods**

3.1 A brief introduction to Indian Miniature Schools
3.2 Western- Indian and Pala school
3.3 Rajasthani and Pahari School
3.4 Mughal and Deccan School
3.5 Modern Trends in Indian Art

Unit- 4: Graphic printing through Serigraphy and Lithography **10 Periods**

4.1 The history of stencils and silkscreen
4.2 The use and maintenance of the squeeze
4.3 Solvents for cleaning
4.4 History and the methods of lithographic prints
4.5 The use and characteristics of the Litho stone/Zincplates
4.6 Use of lithographic chalks and ink (Tusche)
4.7 Papers used in lithography

Unit-5 Etching and Engraving **11 Periods**

5.1 Introduction to intaglio technique
5.2 History, methods and materials of Intaglio techniques
5.3 Preparing the plate and laying the ground and Inking
5.4 Characteristics of different types of grounds
5.5 Characteristics and use of various acids
5.6 Colour etching, use of stencils and marks.

References

1. Ananda Kentish Coomaraswamy (1985); Fundamentals of Indian art: Themes and Concept
2. Swarajya Prakash Gupta,Shashi Asthana (2007);Elements of Indian art
3. Lokesh Chandra Sharma(1979); A brief History of Indian Painting
4. Karl Theodor Schlicher (1935); The Fundamentals of Lithographic paintings
5. Otto G. Ocvirk (1998); Art Fundamentals: Theory and Practice

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

V Semester (Life Skill Curriculum)

BBT 5 - IIIB Sculpture (Value Oriented Life Skills**)**

Marks: External 50 + internal 50 **Total Periods: 45**

Unit- 1: Introduction to Sculpture **08 Periods**

1.1 Relief and round sculpture
1.2 Modeling with clay
1.3 Terra-cotta
1.4 Carving in wood and stone
1.5 Bronze casting
1.6 Use of plaster of Paris
1.7 Metal welding

Unit- 2: History of Indian Sculpture **10 Period**

2.1 Ajanta Murals
2.2 Influence of Ajanta on later Indian Art
2.3 Ellora Cave
2.4 Mughal Miniatures
2.5 Rajput, Pahari&Deccani Miniatures
2.6 Kalighat Patachitras

Unit- 3: Western Sculpture-I **06 Periods**

3.1 Realism –Gustave Courbet & Mille
3.2 Impressionism—Manet, Monet, Renoir, Degas
3.3 Post Impressionism—Gauguin, Van Gogh, Seurat, Cezanne
3.4 Fauvism-Matisse
3.5 German Expressionism
3.6 Edward Munch, Modigliani

Unit-4: Western Sculpture-II **10 Periods**

4.1 Influence of Cubism on later Modern Art
4.2 Russian Constructivism –Tatlin, Gabo, Pevsner
4.3 Neo-Plasticism-Mondrian
4.4 Suprematism—Malevich
4.5 Modern Sculpture-Rodin, Brancusi, Giacometti, Henry Moore
4.6 Futurism-A brief Introduction
4.7 Dadaism- Marcel Duchamp

Unit-5 Aesthetics (Indian and Western) **11 Periods**

5.1 Eminent aesthetic thinkers from classical, medieval and renaissance period
5.2 Aesthetics ideas and Theories of Beuty
5.3 Renaissance approach to Virtual art
5.4 Leo Baptistra Albertti
5.5 Leonardo da Vinci
5.6 Aristotle

References

1.CharlesHarrison (2009); An Introduction of Art
2. Ruth Butler (1975); Western Sculpture: Defination of Man
3. Peter Osier (2015); The History of western Sculpture
4. Dr. Colin Lyas (2002); Aesthetics

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

V Semester (Life Skill Curriculum)

BBT 5 - IIIB Applied Art (Value Oriented Life Skills**)**

Marks: External 50 + internal 50 **Total Periods: 45**

Unit- 1: Introduction to Calligraphy **08 Periods**

1.1 Basic calligraphic strokes for English
1.2 Calligraphic Upper case Alphabets
1.3 Calligraphic Lower case Alphabets
1.4 Composing Alphabets
1.5 Composing a calligraphic paragraph
1.6 Composing a meaningful poem.
1.7 Creating a calligraphic certificate of merit

Unit- 2: Lettering & Typography **10 Period**

2.1 Construction of a San-serif Font (Futura)
2.2 Construction of a Serif Font (Roman)
2.3 Parts of the Letters.
2.4 Optical Spacing & Mechanical spacing
2.5 Expressive Typography.

Unit- 3: Graphic Designing-I **06 Periods**

3.1 Use of drawing instruments
3.2 Creating simplified forms with the use of basic shapes
3.3 Four stages of simplifications. (Realistic to One tone)
3.4 Creation of graphic forms on subjective matter like Rainy season etc.
3.5 Creation of Symbol & Logo.

Unit-4: Graphic Design-II **10 Periods**

4.1 Creating corporate identity with Visiting Card designing
4.2 Use of Logo & Symbol to create a Letter Head design as a part of CI. Corporate Identity
4.3 Creating an envelope design.
4.4 Sticker design with a social purpose.
4.5 Invitation Card designing

Unit-5 Computer Graphics **11 Periods**

5.1 Creating a new file with its Management & setting up a new page.
5.2 Moving around, Inserting and sorting pages of graphics.
5.3 Selecting and manipulating the graphic objects.
5.4 Designing an organizational chart.
5.5 Changing out line, fill, and properties of an object & copying it.
5.6 Adding symbols and clip art to the graphic.
5.7 Importing & transforming file to create a flyer.

References

1.Margaret Shepherd (2013); Learn calligraphy: The complete book of lettering and Design
2. Paul Luna (2018); Typography a very short Introduction
3. Cari Ferraro (2018); The complete Book of Calligraphy and Lettering
4. James D Foley, Foley Dan Van, Andries Van Dam (1996); Computer Graphics
5. Er. Nagesh; Computer Graphics

.

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

VI Semester (Major Curriculum)

BBT 6 – IIA-A: Pharmaceutical Biotechnology (Major Core**)**

Marks:Internal 50 + External 50 Total Periods:45

Unit –I: Introduction to Pharmaceutical Biotechnology **Period: 9**

1.1 Historical Perspective.
1.2 Biotechnology in pharmaceutical industry
1.3 Current Trends in Drug Development.
1.4 Fermentation products in pharmaceutical industry
1.5 Types of antibiotics and synthetic antimicrobial agents.
1.6 Clinical uses of antimicrobial drugs.
1.7 Mechanisms of action of antibiotics.
1.8 Chemical disinfectants and antiseptics
1.9 Identification and Development of New Antimicrobial Drugs.

Unit -II: Biopharmaceuticals & Microbial aspects **Period: 9**

2.1 Vaccine: Genetically improved vaccines, Synthetic peptide-based vaccines, Nucleic acid vaccines.
2.2 Technical aspects of vaccine production
2.3 Plants as bioreactor for pharmaceutical products
2.4 Principles and practice of sterilization.
2.5 Contamination of non-sterile pharmaceuticals
2.6 Sterile pharmaceutical products.
2.7 Sterility testing.

.

Unit- III: Biopharmaceutical applications **Period: 8**

3.1 Biopharmaceuticals and pharmaceutical biotechnology
3.2 Large-Scale Production of Recombinant Proteins
3.3 Biosensors in pharmaceuticals.
3.4 Applications of microbial enzymes in pharmaceuticals.
3.5 Production of therapeutically useful substances by recombinant DNA technology.

Unit- IV: The drug development process **Period: 8**

4.1 Drug discovery
4.2 Regulatory and Intellectual property aspects
4.3 Strategies in pharmaceutical products development
4.4 Delivery of biopharmaceuticals
4.5 Pre-clinical trials
   a. Pharmacokinetics and pharmacodynamics
   b. Toxicity studies
   c. Mutagenicity & carcinogenicity
4.6 Clinical trials

Unit- V: Drug manufacturing process and Biogeneric Drugs **Period: 11**

5.1 Introduction to Indian and International Pharmacopoeia
5.2 Good manufacturing practices (GMP).
5.3 International regulations of GMP
5.4 Good laboratory practices (GLP) in pharmaceutical industry.
5.5 Advanced Drug Delivery
   a. Rationale and Basic Principles
   b. Physiologic and Mechanistic Approaches
   c. Molecular Approaches
5.6 Design and layout of sterile pharmaceutical manufacturing unit.
5.7 Introduction to biogenetic drugs
5.8 Bigeneric targets

REFERENCES:

1) Advances in Applied Biotechnology series Vol.10, Biopharmaceutical in transition. Industrial Biotechnology Association by Paine Webber, Gulf Publishing Company Houston.
2) Analytical Microbiology- Edited by Fredrick Kavanagh volume I &II. Academic Press New York.
3) Biotechnology – Expanding Horizon by B.D. Singh., First Edition, Kalyani Publication, Delhi.
4) Biotechnology- Edited by H.J. Rhem & Reed, vol 4 VCH publications, Federal Republic of Germany.
5) Drug carriers in biology & medicine Edited by Gregory Gregoriadis. Academic Press New York.
6) Good manufacturing practices for Pharmaceuticals. By Sydney H. Willing, Murray M. Tuckerman, William S. Hitchings IV. Second edition Mercel Dekker NC New York.
7) Lippincott's illustrative Reviews: Pharmacology Edition: 02 Maryjnycck by Lippincott's review Publisher Pheladelphia 1997.
8) Pharmaceutical Biotechnology by S. P. Vyas & V.K. Dixit. CBS publishers & distributors, New Delhi.
9) Pharmaceutical Microbiology- Edited by W. B. Hugo & A.R. Russel Sixth Edition. Blackwell Scientific Publications.
10) Pharmacognosy by Gokhle S.D., KoKate C.K. Edition: 18, Nirali Publication.
11) Principles of medicinal chemistry Vol. 1 by Kadam S.S., Mahadik K.R., Bothra K.G. Edition: 18, Nirali Publication.
12) Quality Assurance in Microbiology by Rajesh Bhatia, Rattan Lal Ihhpunjani. CBS publishers & distributors, New Delhi.
13) Quality control in the Pharmaceutical industry - Edited by Murray S. Cooper Vol. 2, Academic Press New York.
14) Quniolinone antimicrobial agents- Edited by David C. Hooper, John S. Wolfson. ASM Washington DC.

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

VI Semester (Major Curriculum)

BBT 6 – IIA-B Genetic Engineering (Major Core**)**

Marks: Internal 50 + External 50 Total Periods:45

Unit I: - Introduction to Genetic Engineering **Period: 07**

1.1 Definition and concept of genetic engineering
1.2 Milestones of genetic engineering- Historical perspective.
1.3 Restriction endonucleases: types and mode of action
1.4 Other important enzymes in genetic engineering
1.5 Cloning and expression Vectors
   a. Plasmid Vector (pBR322, pUC18)
   b. Bacteriophage Vector (λ vector)
   c. Cosmid and Phasmid vectors
   d. Artificial chromosome Vector
   e. Vectors for plants
1.6 Competent Host

UNIT II: Screening of DNA Inset **Period: 08**

2.1 Reporter gene
2.2 Sequence dependent Screening
   a. Colony Hybridisation
   b. Chromosome walking
   c. Differntial screening
   d. Screening by PCR
   e. Gene Tagging
2.3 Expression Based Screening
   a. Hybrid Selection
   b. Colony screening with antibodies
   c. Fluorescence Activated Cell Sorter (FACS)
   d. Marker rescue approach
2.4 Production of recombinant proteins
2.5 Genetic Markers

Unit-III: Tools and Techniques in Genetic Engineering **Period:11**

3.1 Nucleic acid purification,(Total and plasmid DNA)
3.2 DNA sequencing techniques (Maxam-Gilbert's method, Sanger's Dideoxy method)
3.3 Blotting techniques (Southern, Northern and Western)
3.4 PCR: Mechanism, Types, Application, Advantages and limitations of PCR
3.5 Site Directed Mutagenesis
3.6 Microarray Technique

Unit IV: Methods of gene transfer and Gene Libraries **Period: 8**

4.1 Direct and Indirect Methods of Gene Transfer
4.2 Genomic DNA Libraries
4.3 Sub genomic libraries
4.4 cDNA libraries

4.5 Subtracted Cloning

Unit V: Applications of r-DNA technology. **Period: 11**

5.1 Antisense and ribozyme technology
5.2 Genetic modifications in food industry
5.3 Role of genetic engineering in Agriculture
5.4 Gene Manipulations and Medicinal Science
5.5 Transgenic Plants and their applications
5.6 Transgenic animals and their applications
5.7 Fuel Biotechnology

Refferences:

1. Nicoll D.S.T. (2002) An Introduction to Genetic Engineering. 2nd Edition, Cambridge University Press, UK.
2. Watson J.D. (1996) *Recombinant DNA*. Scientific American Books, USA.
3. Mahesh S. and Vedamurthy A.B. *Biotechnology-4* (rDNA Technology, Environmental Biotechnology, Animal cell culture), New Age International Publisher.
4. Brown T. A. (1998) *Gene Cloning: An Introduction*. 3rd Edition, Stanley Thornes
5. Glick B.R. and Pasternak J.J. (1998) *Molecular Biotechnology– Principles and Applications of recombinant DNA*. 2nd Edition, ASM Press, USA.
6. Sambrook J. and Russell D.W. (2001) *Molecular Cloning: A Laboratory Manual*. 3rd Edition. Cold Spring Harbor Lab Press, USA.
7. Innis M.A., Gelfand D.H. and Sninsky J.J. (1999) PCR Applications: Protocols for Functional Genomics. Academic Press, USA.
8. D.M. Glover (1980) *Genetic Engineering, Cloning DNA*. Chapman and Hall, New York, 1980.

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

VI Semester (Major Curriculum)

BBT 6– II B: Animal Cell Culture Techniques (Major Supportive)

Marks: Internal 50 + External 50 **Total Periods: 45**

UNIT I: Introduction to Animal Cell and Tissue Culture **Period: 7**

1.1 Historical background and Scope of Animal cell and Tissue culture
1.2 Terminologies in cell culture: Organ, cell, histotypic, organotypic, primary culture and cell line
1.3 Advantages and limitations of animal cell culture
1.4 Origin of cultured cells
1.5 Primary and established cell line cultures
1.6 Properties of animal cells in culture conditions

Unit-II: Laboratory requirements and Media for Cell Culture **Period: 8**

2.1 Laboratory layout
2.2 Infrastructure for cell culture: Equipment's, culture vessel and materials
2.2 Sterilization of culture media, equipment and apparatus
2.3 Culture media: a) Natural media b) Defined media.
2.4 Balanced salt Solution
2.5 Preparation of various tissue culture media
2.6 Serum and Serum free media

Unit-III: Techniques of Cell Culture **Period: 10**

3.1Disintegration of Tissue: a) Mechanical Methods b) Enzymatic Methods
3.2 Measurement of viability and cytotoxicity
3.3 Measurement of growth parameters
3.4 Primary cell culture, establishing & maintenance of Lymphocyte culture.
3.5 Risks and safety in the animal cell culture

Unit IV: Animal Biotechnology **Period: 10**

4.1 Stem cell cultures, embryonic stem cells and their applications
4.2 Three dimensional culture and tissue engineering
4.3 Principles and Methods of Development of Transgenic animals
4.4 Invitro fertilization and embryo culture
4.5 Large Scale Cultivation of Mammalian cell.
4.6 Transgenic animals

Unit-V: Applications of Cell Culture **Period: 10**

5.1 Hybridoma and monoclonal antibody
5.2 Gene Therapy
5.3 Development of mouse models for cancer research
5.4 Ribotyping
5.3 Cell Repositories, their function.
5.4 Ethical issues: Animal Welfare and Animal rights

References:

1. *Culture of animal cells* (3rd Edition) by Freshney R.I. Wiley-Liss.
2. *Genes* VIII by Lewin. Pearson Education International, NJ, USA, 2004.
3. *Animal Cell Culture – Practical Approach* Edited by John RW. Masters, Oxford.
4. *Cell Growth and Division: A Practical Approach* edited by Basega R, IRL Press.
5. *Animal Cell Culture Techniques* edited by Martin Clynes, Springer.
6. *Methods in Cell Biology Vol.57, Animal Cell Culture Methods* edited by Mather JP and Barnes D, Academic Press.
7. *Biotechnology* by Satyanarayana U. Books and Allied (P) Ltd., Kolkata, India, 2005.
8. *Cell and Molecular Biology* (8th edition) by de Robertis EDP and de Robertis EMF (Jr). Lippincott Williams & Wilkins, Philadelphia, 2001.
9. Textbook of Animal Biotechnology by B singh ; Energy and resource institute,2005.

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

VI Semester (Major Curriculum)

BBT 6-IIC-A Lab Course-7 (Major Innovative)
(Based on major core, major supportive and job oriented curriculum)

Marks: Internal 50 + External 50 **Total Periods: 45**

---

1. **1.** Transformation of E. coil and selection of recombinants.
2. PCR program setting and working demonstarti
3. Restriction mapping of recombinant DNA
4. Southern blotting techniques
5. probles based on PCR, Restriction maping, r-DNA techniques
6. Cultivation of Mushroom
7. Preparation of spawn
8. Determination of Nutritive value of Mushroom
9. Spectrophotometric/ Microbiological methods for the determination of Griseofulvin.
10. Microbial production and Bioassay of Penicillin.
11. Bioassay of Chloramphenicol/Streptomycin by plate assay method or turbidometric assay methods.
12. Screening, Production and assay of therapeutic enzymes: Glucose Oxidase/Asparaginase/beta lactamase.
13. Treatment of bacterial cells with cetrimide, phenol, and detection of Leaky substances such as amino acids, nucleic acids as cytoplasmic membrane damaging substances.
14. Determination of MIC and LD50 of Ampicillin / Streptomycin.
15. Sterility testing by using *B. sterothermophilus / B. subtilis.*
16. Testing for microbial contamination. Microbial loads from syrups, suspensions, creams, and other preparations, Determination of D-value and Z-value for heat sterilization in pharmaceuticals
17. Determination of antimicrobial activity of chemical compounds (like phenol, resorcinol and formaldehydes) Comparison with standard products.
18. Animal cell culture media preparation, sterilization, washing, packing
19. Observation of cells in culture – Principles & practice
20. Lymphocyte culture
21. Maintenance of cell lines (Sp2O),
22. Viable cell count and growth studies
23. Preparation of monolayer cell culture

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

VI Semester (Major Curriculum)

BBT 6-IIC-B Combined Project (Major Innovative)

Marks: Internal 50 + External 50 **Total Periods: 45**

A group of of 4-5 students have to select, design and standardize the protocols for a research work .The topics of research may be from basic or applied biotechnology and can perform work in college or research institute, but he/she must present in college for at least minimum hours prescribed by university, failing to which they will not allowed to appear for semester exams. Student's performance shall be assessed on the basis of 'selection, Knowledge, thinking and applications of research work'. Students have to submit their research work book copy (Separate for each student) to the university, during the semester internal exams.

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

VI Semester (Life Skill Curriculum)

BBT 6 – IIIA Mushroom Production Technology (Job Oriented Life Skills**)**

Marks: Internal 50 + External 50 **Total Periods: 45**

Unit-I-Introduction to Kingdom Fungi **Period: 8**

1.1 Characteristics of fungi
1.2 Historical Introduction to mycology
1.3 Significance of Fungi to humans
1.4 Detail classification of fungi
1.5 Detailed classification of basidiomycetes
1.6 Detailed Classification of ascomycetes

Unit-II-Basic Concepts related to mushroom **Period: 8**

2.1 Introduction and characteristics of mushroom
2.2 Life Cycle of Mushroom
2.3 Common types of edible mushroom
2.4 Common types of poisonous mushroom
2.5 History of mushroom cultivation in India

Unit-III-Market value of mushroom **Period: 9**

3.1 Global status of mushroom production
3.2 Current status of mushroom cultivation in India
3.3 Food value of Mushroom
3.4 Medicinal Value of Mushroom
5.5 Techniques to distinguish poisonous mushroom

Unit-IV-Methodology of mushroom cultivation **Period: 10**

4.1 Selection of site
4.2 Design, infrastructure and layout of mushroom farm
4.3 Agar and grain culture of mushroom
4.4 Spawn Laboratory and spawn preparation
4.5 Principle techniques of compost and composting
4.6 Non compost techniques
4.6 Post Harvesting and handling techniques

Unit-V-Mushroom management and Biotechnology **Period: 10**

5.1 Strategies for mushroom formation
5.2 Environmental factors and sustainable crop
5.3 Cultivation problems and their solution
5.4 pests of mushroom culture
5.2 Mushroom biotechnology and its applications
5.5 Genetic improvement of mushroom culture

References

1. Nita Bahl, Handbook of Mushroom ,Fourth Edition ,Oxford and IBH Publishing company Pvt Ltd, New Delhi
2. Nicholas P Money, Mushroom, Oxford University Press New York
3. Nina Lovering Marshall, The Mushroom Book, A popular guide to the identification and study of our common fungi, Applewood Books, Bedford, MA 01730
4. Kent H. Mc Knight and Vera B. McKnight , Petersons Field Guides Mushrooms ,Houghton Miffilin Company,USA
5. Susan Metzeler and Van Metzler ,Texas Mushroom :A field guide; First Edition,1992,University of Texas Press, Japan
6. Martin W. Ball; Mushroom Wisdom,Ronin Publishing,Inc;Oakland.CA 94609
7. Jon T Fletcher and Richard H Gaze; Mushroom : Pest and Disease Control;Manson Publishing Ltd, London
8. Nicholas L.G. and Keery Ogame; Psilocybin: Mushroom Handbook; Quick Trading ; Canada.
9. Robinson W; Mushroom culture its extension and improvement; Georgr Routledge and sons limited; New York.
10. Suman B.C. and Sharma V.P. Mushroom Cultivation in India; Daya Publishing House Delhi
11. David G. Spoerke and Barry H Rumack ; Handbook of Mushroom Poisoning; Diagnosis and Treatment;CRC Press ,Florida
12. John A. Buswll and Philip G Miles. Genetics and Breeding of edible Mushrooms; Gordon and Breach Science Publishers
13. C Leonard Fergus and Charles Fergus; Common Edible Mushrooms of Northeast; Stackpole Books USA.

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

VI Semester (Life Skill Curriculum)

BBT 6 - IIIB Hindustani Music (Value Oriented Life Skills**)**

Marks: External 50 + internal 50 **Total Periods: 45**

Unit- 1: Technical terms **08 Periods**

1.1Introduction to Music Sangeet,
1.2 Nada: ahata & anahata
1.3 Shruti & its five jaties
1.4 Seven Vedic Swaras
1.5 Seven Swaras used in Gandharva
1.6 Suddha & Vikrit Swara
1.7 Vadi- Samvadi, Anuvadi-Vivadi,
1.8 Saptak, Aroha and Avaroha

Unit- 2: Folk Music **10 Periods**

2.1 Origin of folk music
2.2 Evolution and Classification
2.3 Characteristics of folk music
2.4 Ragas and Talas used in folk music
2.5 Folk fairs & festivals in India.

Unit- 3: Rasa and Aesthetics **06 Periods**

3.1 Principles of Rasa according to Bharata and others
3.2 Rasa nishpatti and its application
3.3 Bhava and Rasa
3.4 Rasa in relation to swara, laya, tala, chhanda and lyrics
3.5 Aesthetics according to Indian Philosophers
3.6 General history of Raga-Ragini

Unit- 4: Contribution of composers / performers to Indian Music **10 Periods**

4.1 M.S. Subbhalakshmi
4.2 Pt. Ravi Shankar
4.3 Utsad Bismillah Khan
4.4 Lata Mangeshkar
4.5 Pt. Bhima Sen Joshi.
4.6 Kishori Amonkar

Unit-5 Gharna , Institutional System and conferences of Hindustani Music **11 Periods**

5.1 Origin and development of Gharana
5.2 Four baanies of Dhrupad and its importance
5.3 Purab and Punjab Angas of Tumari.
5.4 Important music conferences in India
5.5 National and International awards in the field of music

References

1. Bigamudre Chaitanya Deva (1981);An Introduction to Indian Music
2. Neil Sorrel,Ram Narayan (1980); Indian Music in Performance: A practical Introduction

3. Manorma Sharma (2007);Music Aesthetics
4. Mohan Pandey (2012); Dynamics of Indian Folk music

Swami Ramanand Teerth Marathwada University, Nanded's
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

VI Semester (Life Skill Curriculum)

BBT 6 - IIIB Instrumental and Vocal Music (Value Oriented Life Skills**)**

Marks: External 50 + Internal 50 **Total Periods: 45**

Unit- 1: Concept and Terms **08 Periods**

1.1 Sangit Utpatti
1.2 Musical scales (Indian and western)
1.3 Detail study of Gram
1.4 Murchchhana and Chatussarna
1.5 Jaati Lakshana and Jaati Bhed,
1.6 concept of Raag and Raag-Lakshan.

Unit- 2: Raag and its Classification **10 Period**

2.1 Classification of Raag
a. Gram Raag and Deshi Raag Classification
b. Male Raag classification
c. Thaat Raag classification
d. Shuddha, Chhayalag and Sankeerna Raag classification
e. Raag-Raagini classification
f. Raagang classification
2.2 Time theory of Raagas
2.3 Description of popular Raagas and Taalas
2.4 Merits and demerits of a vocalist
2.5 Karnatak names of Popular Hindustani Ragas

Unit- 3: Compositional forms **06 Periods**

3.1 Prabandh
3.2 Dhrupad
3.3 Dhamaar
3.4 Saadra Kheyaal
3.5 Tarana
3.6 Trivet
3.7 Chaturang
3.8 Raagmaala etc
3.9 Thumri
3.10 Dadra

Unit-4: Musical Instruments and its Classification **10 Periods**

4.1 Classification of Indian Musical
4.2 Instruments in Ancient, Medieval and Modern period
4.3 Different types of Veenas in ancient period
4.4 Sitar, Sarod and Violin
4.5 Dilruba, Israj and Santoor
4.6 Flute and its varieties
4.7 Harmonium Avanaddha - Pakhawaj, Tabla and Mridangam

Unit-5: Popular instruments used in Rabindra Sangeet **11 Periods**

5.1 Esraj
5.2 Guitar
5.3 key board
5.4 Sitar
5.5 Tanpura
5.6 Organ – Piano

References

1.Martin Clayton (2008); Time in Indian Music
2.Madhumita Dutta (2008); Let's Know Music and Musical Instruments of India
3.Amrita Priyamyada (2009); Encyclopaedia of Indian Musical Instruments
4.S. Krishnaswami (2017); Musical Instruments of India
5. Bigamudre Chaitanya Deva (1995); Indian Music
6.Santideba Ghosha (2006); Rabindra sangeet Vichitra
7.Beerendra Bandyopadhyay (1981); Rabindra Sangit

Swami Ramanand Teeth Marathwada University, Nanded
NEW MODEL DEGREE COLLEGE, HINGOLI
B.SC. Biotechnology (Semester Pattern)

V Semester (Life Skill Curriculum)

BBT 5 - IIIB Rabindra Sangit (Value Oriented Life Skills**)**

Marks: External 50 + Internal 50 **Total Periods: 45**

Unit- 1: Introduction to Rabindra Sangeet **08 Periods**

1.1 ragas and raginis
1.2 knowledge of talas
1.3 knowledge of kirtana, baul and other folk songs of Bengal
1.4 monsoon and vernal ragas and raginis
1.5 Rabindra Nath Tagore specially created talas
A. Jhampak
B. Sasthi
C. Rupakra
D. Nabatal
E. Ekadasi
F. Nabapanchatal
G. Mulgan
H. Bhanga Gan
1.6 Brahma sangeet by Tagore's

Unit- 2: Historical Perspective of Music: **6 Period**

2.1 Western scholars on Tagore Music
2.2 Influence of European music as a whole on Tagore
2.3 Influence of European Music and provincial tune
2.4 Tagore's creative journey in song writing and musical compositions
2.5 History of Anthology of Tagore songs

Unit- 3: Composition forms **10 Periods**

3.1 Main forms for Rabindra Sangeet.
3.2 Aesthetic approach of Rabindranath Tagore
3.3 Tagore's Philosophy of Music
3.4 Sahityer pathe
3.5 Sahitya
3.6 Sahityer Swarup

Unit-4: Rabindra Gharana System of Music **10 Periods**

4.1 Periods and phases of Tagore's musical compositions.
4.2 Influence of Hindustani, Karnataka and Western music on Rabindra Sangeet
4.3 The cultural atmosphere of Tagore's family
4.4 Thematic Variations of Tagore's music
4.5 National Anthem of India and Bangladesh
4.6 Rabindra Sangeet based on classical tune

Unit-5 Popular instruments used in Rabindra Sangeet **11 Periods**

5.1 , Esraj
5.2 Guitar
5.3 key board
5.4 Sitar
5.5 Tanpura
5.6 Harmonium
5.7 Sarod
5.8 Violin
5.9 Mandira

5.10 Organ – Piano
5.11 Flute and its varieties

References

1.Beerendra Bandyopadhyay (1981); Rabindra Sangit
2. Ghosh (1970); Rabindra Sngit
3. Suchitra Mitra (1983); Rabindra sangit Jigyasa
4. Shantideb Ghosh (1962);Rabindra Sangit
5.Rabindranath Tagore (1979);Rabindra Sangit
6.Shantideb Ghosh (1978);Music and Dance in Rabindranath Tagore's education Phillosophy
7. Sudhirkumara Nandi (1999); Art and aesthetics of Rabindra Nath Tagoe
8. Shantideba Ghosh (2006); Rabindra Sangit Vichitra