

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED**

**B.Sc. GENERAL (SEMESTER PATTERN)  
B.Sc. SECOND YEAR  
BIOTECHNOLOGY (VOCATIONAL) - CURRICULUM**

**With Effect from June - 2014**

**(Revised Pattern- June 2014)**

**B. Sc. BIOTECHNOLOGY (VOCATIONAL) CURRICULUM  
(SEMESTER PATTERN)**

<b>Class</b>	<b>Paper No. Code no.</b>	<b>Title of Paper</b>	<b>Periods/ Practical's</b>	<b>Time duration of Examination</b>	<b>Maximum Marks</b>
B.Sc.IIyr Semester-III	Paper -I VBT- 1.6	Molecular Biology	45	3 Hrs.	40+10*
	Paper -II VBT-1.7	Biophysical techniques	45	3 Hrs.	40+10*
B.Sc.IIyr Semester-IV	Paper -III VBT-1.8	Immunology & Animal Cell Culture	45	3 Hrs.	40+10*
	Paper -IV VBT-1.9	Recombinant DNA Technology	45	3 Hrs.	40+10*
B.Sc.IIyr	VBP- X (Practical) Annual pattern	Practical Based On Theory Papers Of VBT-1.6 &VBT-1.9	15	4 Hrs. for two consecutive days	50
B.Sc.IIyr	VBP-XI (Practical) Annual pattern	Practical Based On Theory Papers Of VBT-1.7 & VBT-1.8	24	4 Hrs. for two consecutive days	50

\* Internal marks

**Workload:**

- Theory:** Per paper per week three periods
- Practical:** Per batch per week two practical (Three periods)

**B. Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL)  
SEMESTER – III  
THEORY PAPER I  
VBT- 1.6 (MOLECULAR BIOLOGY)**

Periods – 45

Maximum Marks – 50

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**Unit-I (12 Periods)**

Structure of DNA. & different forms of DNA  
DNA replication in prokaryotes and eukaryotes.  
DNA recombination: Molecular mechanisms in prokaryotic and eukaryotic  
DNA repair mechanism

**Unit-II (12 periods)**

Structure of prokaryotic genes  
Prokaryotic transcription  
Prokaryotic translation  
Prokaryotic gene expression (*lac*, *his*, *trp*, catabolic repression)

**Unit-III (11 Periods)**

Genome organization in eukaryotes  
Structure & types of chromosomes  
Eukaryotic transcription  
Eukaryotic translation  
Post transcriptional modification of m-RNA, t-RNA, and r-RNA

**Unit-IV (10 Periods)**

Post translation modification in eukaryotes  
Gene organization and expression in mitochondria and chloroplasts  
*Drosophila* and *Arabidopsis* as a model organism

**Text & References:**

1. Molecular biology of Gene- Watson
2. Molecular Cell Biology - Lodish.
3. Molecular Biology - David Frifielder
4. Genomes – T.A.Brown
5. Molecular Biology- Upadhyay.
6. Gene VIII- Lewin

**B. Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL)  
SEMESTER – III  
THEORY PAPER II  
VBT- 1.7 (BIOPHYSICAL TECHNIQUES)**

Periods – 45

Maximum Marks – 50

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**Unit-I (10 Periods)**

Study of compound, light, and electron microscope  
Lambert –beer law, spectrophotometers, colorimeters.  
Centrifuges: principle, instrumentation and applications

**Unit-II (10 Periods)**

Chromatographic techniques: paper chromatography, Thin layer chromatography (TLC), High performance liquid chromatography (HPLC) and gas liquid chromatography (GLC)  
General principles of electrophoresis; Poly acrylamide gel electrophoresis (PAGE), Agarose gel electrophoresis, and Pulse field gel electrophoresis

**Unit-III (13 Periods)**

X-ray crystallography and Nuclear magnetic resonance (NMR).  
General spectroscopy- UV-Visible, fluorescent, atomic absorption, Infrared spectroscopy, Raman spectroscopy.  
Principle, instrumentation and applications of Geiger-Muller counter,

**Unit-IV (12 Periods)**

Physical methods of imaging intact biological structures:  
Ultrasound  
Optical filters  
X-ray  
Computerized Tomography (CT) scan  
Electro cardio gram (ECG)  
Electro encephalo gram (EEG)  
NMR imaging

**Text & References:**

1. Biophysical Chemistry – Nath & Upadhyay
2. Instrumental Methods of Chemical Analysis – P.K.Sharma
3. Practical Biochemistry Principles & Techniques- Wilson Walker
4. Handbook of Biomedical Instrumentation- R.S. Khandpur.
5. Principles & techniques of biochemistry molecular biology - Wilson walker
6. Physical biochemistry- David Frifielder

**B. Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL)  
SEMESTER – IV  
THEORY PAPER I  
VBT- 1.8 (IMMUNOLOGY & ANIMAL CELL CULTURE)**

Periods – 45

Maximum Marks – 50

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**Unit-I (10Periods)**

The immune system and immunity along with historical perspective  
Antigen –antibody and their structure  
The organs and the cells of the immune system and their function  
Antigen –antibody interactions

**Unit-II (12 Periods)**

Humoral and cell mediated immunity (role of MHC in Ag presentation)  
Study of Complement system  
Hypersensitivity reactions and its types  
Immunity to infectious diseases, vaccines

**Unit-III (12 Periods)**

History of development of cell culture  
Culture media, natural media and synthetic growth medium  
Importance of growth factors of the serum  
Primary cultures: Isolations methods, Anchorage dependence of growth.  
Anchorage Independent cells.

**Unit-IV (11 Periods)**

Secondary cultures transformed animal cells, established / continuous cell lines  
Commonly used animal cell lines-their origin and characteristics  
Growth kinetics of cells in culture  
Application of animal cell culture for studies on gene expression  
Organ culture  
Transfection of animal cells: selectable markers, HAT selection,  
Antibiotic resistance etc  
Transplantation of cultured cells

**Text & References:**

1. Immunology – Kuby
2. Textbook of Microbiology – R.Anantnarayan
3. Essentials of Immunology- Roitt.I.M
4. Immunology – Nagoba
5. Biotechnology-R.C Dubay
6. Biotechnology –B.D.Singh
7. Animal Tissue Culture- Paul
8. Cell Biology –Rastogi
9. Animal cell culture – Freshney

**B. Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL)  
SEMESTER – IV  
THEORY PAPER II  
VBT- 1.9 (RECOMBINANT DNA TECHNOLOGY)**

Periods – 45

Maximum Marks – 50

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**Unit-I (12 Periods)**

What is gene cloning and why do we need to clone a gene?

Tools & techniques plasmids and other vehicles genomic DNA, handling of DNA, RNA, cDNA, RT enzymes & other reagents techniques, laboratory requirement.

Safety measures and regulations for Recombinant DNA work

Choice and selection of the tools and the techniques.

**Unit-II (11Periods)**

Vectors; Plasmids, cosmids, phagmids & bacteriophages, BAC, YAC

Introduction of DNA in to living cells.

Cloning vectors for *E.coli*.

Cloning vectors for organisms other than *E.coli yeast, fungi*, and animal viruses.

Agrobacterium mediated gene transfer in plants, plant viruses,

**Unit-III (12Periods)**

Techniques of gene expression: Southern, Northern, Western blotting,

DNA foot printing, gel retardation technique,

DNA and RNA Probes

DNA sequencing methods

PCR and its applications

**Unit-IV (10Periods)**

Production of proteins from cloned genes

Gene cloning in medicines

-pharmaceutical compounds

-Artificial insulin gene

-Recombinant vaccines

-Diagnostic tests

**Text & References:**

1. Gene cloning –T.A. Brown
2. Biotechnology – R.C.Dubey
3. Biotechnology – P.K. Gupta
4. Biotechnology- Kumarsen
5. Biotechnology- B.D.Singh
6. Molecular biology of the gene – Watson J.D
7. Genetic engineering – Sandhya Mitra

**B.Sc. SECOND YEAR, BIOTECHNOLOGY (VOCATIONAL)  
PRACTICAL PAPER – X (Annual)  
BASED ON THEORY PAPERS OF VBT-1.6 &VBT-1.9**

Practical – 15

Maximum Marks – 50

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**MOLECULAR BIOLOGY & RECOMBINANT DNA TECHNOLOGY**

- Practical 1: Isolation of DNA from Bacteria.
- Practical 2: Estimation of DNA by DPA method
- Practical 3: U.V Spectroscopic analysis of DNA
- Practical 4: Isolation of RNA from *S. cerevisiae*.
- Practical 5: Estimation of RNA by Orcinol method.
- Practical 6: Estimation of protein by Folin –Lowry method.
- Practical 7: Replica plating for transfer of bacterial colony
- Practical 8: Isolation of streptomycin resistant mutant of *E.coli*.
- Practical 9: Study of mutations by physical and chemical methods.
- Practical 10: Agarose gel electrophoresis of extracted DNA
- Practical 11: Isolation of Plasmid DNA.
- Practical 12: Transformation of *E.coli*.
- Practical 13: Restriction digestion of DNA.
- Practical 14: Isolation of Ampicillin resistant bacteria.
- Practical 15: Study of PCR

**B.Sc. SECOND YEAR, BIOTECHNOLOGY (VOCATIONAL)  
PRACTICAL PAPER – XI (Annual)  
BASED ON THEORY PAPERS OF VBT-1.7 & VBT-1.8**

Practical – 24

Maximum Marks – 50

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**IMMUNOLOGY, ANIMAL CELL CULTURE & BIOPHYSICAL TECHNIQUES**

Practical 1: Study of Blood Group.

Practical 2: Determination of Rh factor.

Practical 3: Total RBC count.

Practical 4: Total WBC count.

Practical 5: Differential leucocytes count.

Practical 6: Determination of clotting time of Blood.

Practical 7: Determination of bleeding time of Blood.

Practical 8: Estimation of Hemoglobin.

Practical 9: VDRL Test.

Practical 10: RA Test.

Practical 11: WIDAL test

Practical 12: Cell count by Haemocytometer.

Practical 13: Preparation of Animal cell culture media

Practical 14: Isolation of primary cell culture by enzymatic method

Practical 15: Isolation of chick embryo.

Practical 16: separation of amino acids by TLC & paper chromatography

Practical 17: Principle & working of X-ray.

Practical 18: Principle & working of Ultrasound / Sonography.

Practical 19: Principle & working of ECG.

Practical 20: Principle & working of EEG.

Practical 21: Principle & working of UV-spectrophotometer.

Practical 22: Principle & working of IR-spectroscopy.

Practical 23: Study of SDS-PAGE

Practical 24: Study of centrifuges



**SKELETON OF QUESTION PAPER**  
**B.Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL)**  
**SEMESTER-III**  
**THEORY PAPER – 106 /107**  
**VBT- 1.6 (MOLECULAR BIOLOGY) /**  
**VBT- 1.7 (BIOPHYSICAL TECHNIQUES)**

**Time:** Three hours

**Maximum Marks:** 50

**Note: -** (i) Attempt all questions  
(ii) All questions carry equal marks

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**VBT- 1.6 MOLECULAR BIOLOGY**

<b>Q.1.</b> Multiple choice questions	40
Internal marks	10

**VBT- 1.7 BIOPHYSICAL TECHNIQUES**

<b>Q.1.</b> Multiple Choice Questions	40
Internal marks	10

**SKELETON OF QUESTION PAPER**  
**B.Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL)**  
**SEMESTER- IV**  
**THEORY PAPER – 1.8 /1.9**  
**VBT- 1.8 (IMMUNOLOGY & ANIMAL CELL CULTURE) /**  
**VBT- 1.9 (RECOMBINANT DNA TECHNOLOGY)**

**Time:** Three hours

**Maximum Marks:** 50

- Note: -**
- (i) Attempt all questions
  - (ii) All questions carry equal marks
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**VBT- 1.8 IMMUNOLOGY & ANIMAL CELL CULTURE**

<b>Q.1.</b> Multiple choice questions	40
Internal marks	10

**VBT- 1.9 RECOMBINANT DNA TECHNOLOGY**

<b>Q.1.</b> Multiple Choice Questions	40
Internal marks	10

**PROFORMA FOR PRACTICAL EXAMINATION**  
**SWAMI RAMANAND TREETH MARATHWADA UNIVERSITY, NANDED**  
**Faculty of Science**  
**B. Sc. II year Vocational Biotechnology**  
**Practical Examination**  
**VBP- X (BTT-1.6 & BTT-1.9)**

Time: 9.00 am to 1.00 pm (for two consecutive days)

Marks: 50

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Q 1) Major Question (Molecular biology)	10
Q 2) Minor Question (Molecular biology)	10
Q 3) Major Question (Recombinant DNA technology)	10
Q 4) Minor Question (Recombinant DNA technology)	10
Q 5) Viva-Voce	05
Q 6) Record Book	05

**PROFORMA FOR PRACTICAL EXAMINATION**  
**SWAMI RAMANAND TREETH MARATHWADA UNIVERSITY, NANDED**  
**Faculty of Science**  
**B. Sc. II year Vocational Biotechnology**  
**Practical Examination**  
**VBP- XI (BTT-1.7 & BTT-1.8)**

Time: 2.00 pm to 6.00 pm (for two consecutive days)

Marks: 50

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Q 1) Major Question (Biophysical techniques)	10
Q 2) Minor Question (Biophysical techniques)	10
Q 3) Major Question (Immunology & Animal cell culture)	10
Q 4) Minor Question (Immunology & Animal cell culture)	10
Q 5) Viva-Voce	05
Q 6) Record Book	05