

॥ सा विद्या या विमुक्तये ॥



# स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

“ज्ञानतीर्थ” परिसर, विष्णुपुरी, 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

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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील प्रथम वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०१९-२० पासून लागू करण्याबाबत.

### प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक ०८ जून २०१९ रोजी संपन्न झालेल्या ४४व्या मा. विद्या परिषद बैठकीतील ऐनवेळचा विषय क्र.११/४४-२०१९ च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील प्रथम वर्षाचे खालील विषयांचे C.B.C.S. (Choice Based Credit System) Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०१९-२० पासून लागू करण्यात येत आहेत.

- |   |                                       |
|---|---------------------------------------|
| 1. Agricultural Microbiology                          | 18. Dyes and Drugs                    |
| 2. Agrochemicals & Fertilizers                        | 19. Electronics                       |
| 3. Analytical Chemistry                               | 20. Environmental Science             |
| 4. B.C.A.   | 21. Fishery Science                   |
| 5. B.Voc. (Food Processing, Preservation and Storage) | 22. Food Science                      |
| 6. B.Voc. (Web Printing Technology)                   | 23. Geology                           |
| 7. Biochemistry                                       | 24. Horticulture                      |
| 8. Bioinformatics                                     | 25. Industrial Chemistry              |
| 9. Biophysics   | 26. Information Technology (Optional) |
| 10. Biotechnology (Vocational)                        | 27. Mathematics                       |
| 11. Biotechnonology                                   | 28. Microbiology                      |
| 12. Botany  | 29. Network Technology                |
| 13. Chemistry   | 30. Physics                           |
| 14. Computer Application (Optional)                   | 31. Software Engineering              |
| 15. Computer Science (Optional)                       | 32. Statistics                        |
| 16. Computer Science                                  | 33. Zoology                           |
| 17. Dairy Science                                     |                                       |

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या [www.srtmun.ac.in](http://www.srtmun.ac.in) या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी.

‘ज्ञानतीर्थ’ परिसर,  
विष्णुपुरी, नांदेड - ४३१ ६०६.  
जा.क्र.: शैक्षणिक-०१/परिपत्रक/पदवी-सीबीसीएस अभ्यासक्रम/  
२०१९-२०/२९२

दिनांक : ०३.०७.२०१९.

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, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
- ५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
- ६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

स्वाक्षरित / -

**उपकुलसचिव**

शैक्षणिक (१-अभ्यासमंडळ) विभाग

**Swami Ramanand Teerth Marathwada University Nanded**  
**Choice Based Credit System (CBCS) Course Structure (New scheme)**  
**Faculty of Science and Technology**  
**Subject: Microbiology**  
**B. Sc. First Year (Semester – I & II)**  
Semester Pattern effective from June – 2019

Semester	Paper No./ Course No.	Name of the Course	Instruction Hrs/ week	Total period	Internal Evaluation	Marks of Semester	Total Marks	Credits
I	CCMB I (Section A)	Introductory Microbiology (PI)	03	45	10	40	50	2
	CCMB I (Section B)	Fundamentals of Microbiology (PII)	03	45	10	40	50	2
II	CCMB II (Section A)	Basic Microbiology & Bio-molecules (PIII)	03	45	10	40	50	2
	CCMB II (Section B)	Microbial Physiology (PIV)	03	45	10	40	50	2
	CCMBP I [CCMB I & II (Section A & B)]	Practical's based on Section A & Section B of CCMB I & CCMB II (P V)	04	20 Practical	20	80	100	4
				<b>Total credits semester I and II: 12</b>				

Continuous Assessment for Practical (20) – Test/ Assignment and Record Book

Semester	Course No.	Name of the Course	Instruction Hrs/ week	Total period	Internal Evaluation	Marks of Semester	Total Marks	Credits
III	CCMB III (Section A)	Applied Microbiology (P-VI)	03	45	10	40	50	2
	CCMB III (Section B)	Immunology(P-VII)	03	45	10	40	50	2
	CCMBP II [CCMB III & IV (Section A)]	Practical's based on P-VI & P-VIII (P-X)	04		10	40	50	2
	CCMBP II [CCMB III & IV (Section B)]	SEC I (1 Skill/ optional)			15×3 = 45	-	-	(02)*
IV	CCMB IV (Section A)	Food, Soil Microbiology and Microbial Ecology (P-VIII)	03	45	10	40	50	2
	CCMB IV (Section B)	Medical microbiology (PIX)	03	45	10	40	50	2
	CCMBP III [CCMB III & IV (Section B)]	Practical's based on P-VII & P-IX (P-XI)	04	10 Practicals	10	40	50	2
	CCMBP III [CCMB III & IV (Section B)]	SEC II (1 Skill / optional)			15×3 = 45	-	-	(02)*
				<b>Total credits semester III and IV</b>				12(04)*

Semester/ Annual	Course No.	Name of the Course	Instruction Hrs./ Week	Total Periods	Internal Evaluation (CA)	End Semester Examination (ESE)	Total Marks	Credits
V Semester	DSEMBI (Section A)	Microbial Genetics (P – XII)	03	45	10	40	50	2
	DSEMB I [Section B I ] OR DSEMB I [Section B II]	Microbial Metabolism (P – XIII A) OR Nitrogen Metabolism (P – XIII B)	03	45	10	40	50	2
VI Semester	DSEMB II (Section A)	Molecular Biology (P-XIV)	03	45	10	40	50	2
	DSEMB II [Section B I ] OR DSEMB II [Section B II]	Industrial Microbiology (P – XVA) OR Pharmaceutica I Microbiology ( P – XVB)	03	45	10	40	50	2
Annual Practicals / Skill	DSEMBP I [DSEMB I & II Section A]	Practicals Based on P – XII & P -XIV (P -XVI)	04	10 Practical	10	40	50	2
	SECMB III (A OR B)	Enzyme Technology ( A) OR Molecular Biology Techniques (B)	03	45	25	25	50	(02) *
Annual Practicals / Skill	DSEMBP II [DSEMB I & II (Section B I & II)]	Practicals based on P -XIII A & B & P – XV A & B (P -XVII)	04	10 Practical	10	40	50	2
	SECMB IV (A OR B)	Bioprocess Technology (A) OR Good Manufacturing Practices (B)	03	45	25	25	50	(02) *
Total Credits Semester V & VI								12 (04*)

**Outline and Salient Feature:**

B. Sc. Microbiology syllabus is crafted to serve the need of choice based credit system course structure to orient and practically train students in the field of Microbiology. The course is specifically bringing core courses, skilled enhanced and discipline elective courses together dealing additional domain of knowledge in this field of study where in Core Course includes Introductory and basic microbiology, microbial physiology and biochemistry, applied microbiology, immunology and medical microbiology.

Skill enhanced courses includes public health, diagnostic microbiology, medical laboratory technology and microbial biofertilizers, and also on enzyme, bioprocess technology, GMP and molecular biology techniques is well suited to understand application of scientific and engineering skills to the processing of materials by microorganisms.

DSE course based on microbial genetics and molecular biology is concerned with genes, mutation, recombination, DNA replication, transcription, translation, associated phenomena and their manipulation and techniques of such manipulation. Another DSE course (with choice) provide an option to learn diverse metabolic events occurring in view of the particular microorganisms and its environment and agriculture and to relate this information to a biology as a whole. This course is giving emphasis on enzymology, microbial metabolism, nitrogen metabolism and also offer industrial microbiology or pharmaceutical Microbiology as DSE courses is an area of applied microbiology which deals production of various useful end products on large scale.

**Utility:**

The syllabus of B. Sc. microbiology course will orient and train the students in view of general microbiology, medical microbiology and laboratory technology, microbial genetics and molecular biology, occurrence of metabolic events and its relation to environment and agriculture, Industrial and Pharmaceutical Microbiology to understand and apply this knowledge for carrier orientation.

SE Course will provide additional opportunity for a student to develop skills of interest in this field of study.

**Learning Objectives:**

The learning or training objectives of SEC has been mentioned below the skill of the course.

**Prerequisite:**

The course is offered for a student registered for undergraduate programme in the faculty of Science and technology who had primary training in the field of biology at higher secondary school level evident in terms of certificate by CBSC/ ICSC/HSC for entry level core courses in microbiology optional subject. Whereas for SEC and DSE courses, student preferably needs training in microbial sciences and also likes to gain additional advanced knowledge in this field of science.

**Swami Ramanand Teerth Marathwada University Nanded**  
**Choice Based Credit System (CBCS) Course Structure (New scheme)**  
**Faculty of Science and Technology**  
**B. Sc. First Year (Semester – I)**  
**Subject: Microbiology**  
**Paper Name: Introductory Microbiology (P-I) CCMB I (Section A)**  
**Paper Number: I**

**Credits: 02 (Marks: 50)**

**Periods: 45**

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**Unit I: Scope of Microbiology**

**Periods: 08**

- 1.1 Definition and concept
- 1.2 Types of microorganisms
- 1.3 Distribution of microorganisms in nature
- 1.4 Beneficial & Harmful role of microorganisms in Agriculture, Human & Animal health, Industries and Genetic engineering with suitable examples

**UNIT II: Historical Developments in Microbiology**

**Periods: 15**

- 2.1 Early observation of microorganisms
- 2.2 Controversy over spontaneous generation - Contribution of different scientists
- 2.3 Recognition of microbial role in diseases - Koch's postulates and contribution of Louis Pasteur and Edward Jenner
- 2.4 Recognition of microbial role in fermentation
- 2.5 Discovery of pure culture concept
- 2.6 Aseptic surgery

**UNIT III: General Characters of Microorganisms**

**Periods: 12**

- 3.1 The eukaryotic cell: Algae, Fungi and Lichens.
- 3.2 Prokaryotic cell: Archaeobacteria, Bacteria and Actinomycetes.
- 3.3 Difference between Eukaryotic and Prokaryotic cell.
- 3.4 General characters of viruses
- 3.5 General characters of Protozoa

**UNIT IV: Taxonomy of Microbes**

**Periods: 10**

- 4.1 Microbial Classification and Nomenclature
  - a. Taxonomic groups
  - b. Goals of classification
- 4.2 General methods of classifying bacteria: Intuitive method, Numerical taxonomy and Genetic relatedness.
- 4.3 Nomenclature of bacteria
- 4.4 Introduction to Bergey's Manual of Bacteriology (9th edition)

**References:**

1. Handbook of Microbiology. Bisen P.S., Varma K.: CBS Publishers and Distributors, Delhi. Introduction to viruses: Vikas Publishing House Pvt. Ltd., New Delhi.
2. A textbook of fungi and Viruses by Dubey H.C.: Vikas Publishing House Pvt. Ltd. Delhi.
3. A textbook of Microbiology by Dubey R.C. and D. K, Maheshwary, S Chand and Co. New Delhi.

4. Fundamentals of Microbiology by Frobisher, Hinsdill, Crabtree, Goodheart: W.B. Saunders Company, U.S.A. Toppan Company Ltd., Japan.
5. General Virology by Luria
6. Elementary Microbiology (Fundamentals of Microbiology) Vol. II, Modi H.A.: Ekta Prakashan, Nadiad, Gujrat
7. Modern Microbiology by Parasher Y.K. Campas Books International, New Delhi.
8. Elements of Microbiology by Pelczar Michael J. Jr./E.C.S Chan, McGraw, Hill International Book Company, New Delhi.
9. Microbiology: Concepts and applications by Pelczar Michael J., Jr. E.C.S Chan, Noel R. Krieg: - McGraw Hill Inc.
10. Microbiology by Pelczar Michael J., Reid R.D. and Chan E.C.S. Tata McGraw hill publishing Co. Ltd., New Delhi.
11. General microbiology Vol I and II by Powar C. B. and Dagainawala H.I. Himalaya publishing house, Bombay.
12. Microbiology by Prescott L.M. Harley J.P. and Klein Donald A., W. M. C. Brown publishers.
13. Microbiology: Fundamentals and Applications by Purohit S.S. Agro-Botanical publishers Bikaner, India.
14. Microbiology- Fundamentals and applications by R.A. Atlas
15. Microbiology by Singh R.P., Kalyani Publication.
16. General Microbiology by Stanier Roger Y., Adelberg Edward A. Ingraham Johan L. Prentice-Hall, Englewood Cliffs, New Jersey, Publishing Co. Ltd., New Delhi.
17. Introduction to Microbiology by Tauro P, Kapoor K.K., Yadav K.S. Wiley Eastern Ltd., New Delhi.
18. Microbiology: an Introduction by Tortora G.J. Funke B. and Case Christine L, The Benjamin Publishing Co. New York.
19. Microbiology by Yadav Manju, Discovery Publishing House,
20. Introduction to Microbial Techniques by Gunasekaran
21. Handbook of microbiological media, Hi-media.
22. Practical Microbiology by Dubey and Maheshwari.
23. General Microbiology: Seventh edition by Hans G Schlegel, Cambridge University Press.
24. Willey, Joanne M. Prescott, Harley, and Klein's Microbiology / Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton. — 7th ed. Published by McGraw-Hill, a business unit of The McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY 10020.
25. Brock Biology of Microorganisms, Thirteenth Edition by Michael T. Madigan, John M. Martinko, David A. Stahl, David P. Clark, Benjamin Cummings, 1301 Sansome Street, San Francisco, CA 94111.
26. Manual of Methods for Pure Culture Study, by A. B. Solunke, P. S. Wakte, V. D. Hamde, and R. S. Awasthi, Nirmal Publication Delhi (India).
27. Fundamental Microbiology, First edition by B. M. Sandikar, Books and Allied (P) LTD. Kolkata.



**Swami Ramanand Teerth Marathwada University Nanded**  
**Choice Based Credit System (CBCS) Course Structure (New scheme)**  
**Faculty of Science and Technology**  
**B. Sc. First Year (Semester – I)**  
**Subject: Microbiology**  
**Paper Name: Fundamentals of Microbiology (P – II) CCMB I (Section B)**  
**Paper Number: II**

**Credits: 02 (Marks: 50)**

**Periods: 45**

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**UNIT I: Bioinstrumentation**

**Periods: 12**

- 1.1 Microscopy: Definition of Magnification, Resolving power, Depth of focus, Focal length, Angular aperture and Numerical aperture.
- 1.2 Objectives (Low, High, oil immersion) and oculars function.
- 1.3 Condensers: Abbes, Cardioids, Parabolic and their functions.
- 1.4 Principle, construction using ray diagram and applications of compound microscope:
- 1.5 Electron microscope (SEM and TEM).

**UNIT II: Ultra Structure of Bacterial Cell**

**Periods: 12**

- 1.1 Basic concepts of shape, arrangement, and size of prokaryotes cells, Importance of cell shape, cell size in rods and cocci.
- 1.2 Structure, Chemical composition and function of following:
  - a. Capsule and slimes
  - b. Cell wall and cytoplasmic membranes
  - c. Flagella and Motility, fimbriae and pili
  - d. Nuclear material, Plasmids, Mesosomes and Ribosome
  - e. Reserve materials and other cellular inclusions

**UNIT III - Sterilization Techniques**

**Periods: 11**

- 3.1 Definition of Sterilization, Disinfection, Antiseptic, Germicide, Sanitizer, Fungicide, Viricide, Bacteriostatic and Bactericidal agent.
- 3.2 Chemical Disinfectants: Properties of ideal disinfectant, Chemical Agents: Phenol and Phenolic compounds, Alcohols, Gaseous sterilizing Agents: Formaldehyde, Ethylene oxide and  $\beta$ - Propiolactone.
- 3.3 Evaluation of disinfectant (Phenol coefficient).
- 3.4 Sterilization by Physical Agent a) Moist Heat: Boiling, Tyndallization, Pasteurization and Steam under pressure (Autoclave). Dry heat: Flaming, Incineration and Hot air oven. b) Radiation: Ionizing and Non-Ionising radiations. c) Filtration and Types of filters (Concept with e.g. Seitz filter)

**UNIT IV: Microbial Nutrition**

**Periods: 10**

- 1.1 Concept of microbial nutrition
- 1.2 The common nutrient requirements (Basic Nutritional requirements of Microorganisms /macronutrient and micronutrient)
- 1.3 Requirement for C, H, O and Electron with their significance
- 1.4 Requirements for N, P and S with their significance
- 1.5 Growth factors
- 1.6 Nutritional categories of microorganisms on the basis of carbon and energy source.

## References:

1. Handbook of Microbiology. Bisen P.S., Varma K.: CBS Publishers and Distributors, Delhi. Introduction to viruses: Vikas Publishing House Pvt. Ltd., New Delhi.
2. A textbook of fungi and Viruses by Dubey H.C.: Vikas Publishing House Pvt. Ltd. Delhi.
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13. Microbiology: Fundamentals and Applications by Purohit S.S. Agro-Botanical publishers Bikaner, India.
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**Choice Based Credit System (CBCS) Course Structure (New scheme)**

**Faculty of Science and Technology**

**B. Sc. First Year (Semester – II)**

**Subject: Microbiology**

**Paper Name: Basic Microbiology & Biomolecules (P-III) CCMB II (Section A)**

**Paper Number: III**

**Credits: 02 (Marks: 50)**

**Periods: 45**

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**UNIT I: Microbial Staining Techniques**

**Periods: 11**

- 2.1 Definition: Stain, Dye, Acidic stain, Basic stain, Auxochrome, Chromophore, Mordant, Chromogen, Leuco compound, Natural stain, Fluorochrome, Decolouring agent and Counter stain.
- 2.2 Theories of Staining.
- 2.3 Principles, mechanism, procedure and observation of:
  - a. Simple staining: Monochrome & Negative staining
  - b. Differential staining: Gram's & Acid fast staining
  - c. Structural staining: Cell wall & PHB staining

**UNIT II: The Viruses: Distribution and Structure**

**Periods: 11**

- 2.1 Viruses
- 2.2 Bacterial viruses (Bacteriophages)
- 2.3 Multiplication of Virulent phage: The lytic cycle
- 2.4 The development of temperate phages: Lysogeny
- 2.5 Classification of viruses (LHT system)
- 2.6 Distribution and structure of HIV
- 2.7 Enlist plant animal and human viral diseases with their causative agents

**UNIT III: Biomolecules**

**Periods: 11**

- 3.1 Carbohydrates
  - a. Definition and classification
  - b. Triose, Pentose, Hexose (Examples)
  - c. Disaccharides:- Glycoside linkage ( Lactose, Maltose and Sucrose)
  - d. Oligosaccharides:- Trisaccharides (Raffinose)
  - e. Polysaccharides:- Homo and Heteropolysaccharides
  - f. Biological Significance of carbohydrates
- 3.2 Lipids
  - a. Definition and Classification
  - b. Types of lipids
    - i. Simple lipids:- Triglycerides
    - ii. Conjugated lipids:- Phosphatidic acid, Phospholipids and cholesterol
  - c. Biological importance of lipids

**UNIT IV: Informational and Functional Biomolecules**

**Periods: 12**

- 4.1 Nucleic acids
  - a. Ribose and Deoxyribose sugars, Nitrogen bases, Nucleosides and Nucleotides
  - b. DNA:- Properties, Structure and Functions

c. RNA:- Properties, Structure and Functions

4.2 Proteins

- a. Definition and classification
- b. Peptide bonds
- c. Enzymes
- d. Biological Significance of proteins

**References:**

1. Handbook of Microbiology. Bisen P.S., Varma K.: CBS Publishers and Distributors, Delhi. Introduction to viruses: Vikas Publishing House Pvt. Ltd., New Delhi.
2. A textbook of fungi and Viruses by Dubey H.C.: Vikas Publishing House Pvt. Ltd. Delhi.
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**Swami Ramanand Teerth Marathwada University Nanded**  
**Choice Based Credit System (CBCS) Course Structure (New scheme)**  
**Faculty of Science and Technology**  
**Subject: Microbiology**  
**B. Sc. First Year (Semester – II)**  
**Paper Name: Microbial Physiology (P-IV) CCMB II (Section B)**  
**Paper Number: IV**

**Credits: 02 (Marks: 50)**

**Periods: 45**

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**UNIT I: Bacterial Cultivation and Maintenances**

**Periods: 10**

- 4.1 Cultivation of Bacteria a) Media used, Properties of good culture media. b) Definition, Concept, use and different types of culture media: Synthetic, Non-synthetic, Natural, Selective, Differential, Enriched, Enrichment, Assay, Minimal, Maintenance and Transport Medium.
- 4.2 Buffers in culture medium.
- 4.3 Anaerobic cultivation: Media and methods of anaerobic cultivation
- 4.4 Pure culture Techniques. a) Definition and Significance of pure culture b) Methods of isolation of pure culture: Streak plate, Pour plate, Spread plate and Single cell isolation.

**UNIT II: Permeation**

**Periods: 12**

- 2.1 Passive diffusion
- 2.2 Facilitated diffusion
- 2.3 Active transport mechanism
- 2.4 Group translocation
- 2.5 Uptake of amino acids and sugars (as examples)

**UNIT III: Reproduction and Growth**

**Periods: 15**

- 3.1 Concept of growth
- 3.2 Microbial Reproduction: Binary fission, budding.
- 3.3 Bacterial growth: Definition, growth curve – Phases of growth, Growth Kinetics, Generation time, Methods of measurement of growth, different types of culture system: Batch culture system, Continuous culture system (Chemostat and Turbidostat)
- 3.4 Factors affecting growth-Temperature, pH, Osmotic pressure and Nutrients.

**UNIT IV Bacterial Sporulation**

**Periods: 08**

- 3.1 Bacterial Sporulation- Structure of endospore, Endospore formation (Stages) in *Bacillus*, Spore germination, Significance of Ca-dipicolinate (DPA) and soluble Proteins (SASP)

**References:**

1. Handbook of Microbiology. Bisen P.S., Varma K.: CBS Publishers and Distributors, Delhi. Introduction to viruses: Vikas Publishing House Pvt. Ltd., New Delhi.
2. A textbook of fungi and Viruses by Dubey H.C.: Vikas Publishing House Pvt. Ltd. Delhi.
3. A textbook of Microbiology by Dubey R.C. and D. K, Maheshwary, S Chand and Co. New Delhi.

4. Fundamentals of Microbiology by Frobisher, Hinsdill, Crabtree, Goodheart:: W.B. Saunders Company, U.S.A. Toppan Company Ltd., Japan.
5. General Virology by Luria
6. Elementary Microbiology (Fundamentals of Microbiology) Vol. II, Modi H.A.: Ekta Prakashan, Nadiad, Gujrat
7. Modern Microbiology by Parasher Y.K. Campas Books International, New Delhi.
8. Elements of Microbiology by Pelczar Michael J. Jr./E.C.S Chan, McGraw, Hill International Book Company, New Delhi.
9. Microbiology: Concepts and applications by Pelczar Michael J., Jr. E.C.S Chan, Noel R. Krieg: - McGraw Hill Inc.
10. Microbiology by Pelczar Michael J., Reid R.D. and Chan E.C.S. Tata McGraw hill publishing Co. Ltd., New Delhi.
11. General microbiology Vol I and II by Powar C. B. and Dagainawala H.I. Himalaya publishing house, Bombay.
12. Microbiology by Prescott L.M. Harley J.P. and Klein Donald A., W. M. C. Brown publishers.
13. Microbiology: Fundamentals and Applications by Purohit S.S. Agro-Botanical publishers Bikaner, India.
14. Microbiology- Fundamentals and applications by R.A. Atlas
15. Microbiology by Singh R.P., Kalyani Publication.
16. General Microbiology by Stanier Roger Y., Adelberg Edward A. Ingraham Johan L. Prentice-Hall, Englewood Cliffs, New Jersey, Publishing Co. Ltd., New Delhi.
17. Introduction to Microbiology by Tauro P, Kapoor K.K., Yadav K.S. Wiley Eastern Ltd., New Delhi.
18. Microbiology: an Introduction by Tortora G.J. Funke B. and Case Christine L, The Benjamin Publishing Co. New York.
19. Microbiology by Yadav Manju, Discovery Publishing House,
20. Introduction to Microbial Techniques by Gunasekaran
21. Handbook of microbiological media, Hi-media.
22. Practical Microbiology by Dubey and Maheshwari.
23. General Microbiology: Seventh edition by Hans G Schlegel, Cambridge University Press.
24. Fundamental Microbiology, First edition by B. M. Sandikar, Books and Allied (P) LTD. Kolkata.

**Swami Ramanand Teerth Marathwada University Nanded**  
**Choice Based Credit System (CBCS) Course Structure (New scheme)**

**Faculty of Science and Technology**  
**B. Sc. First Year (Semester – I & II)**

**Subject: Microbiology**

**Paper Name: Annual Practical's based on Section A & Section B of CCMB  
I & CCMB II ( PV)**

**Paper Number: V**

**Credits: 04**

**Marks: 100**

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(Annual Practical's based on Section A & Section B of CCMB I & CCMB II ( PV) (Practical syllabus requires four periods per batch per week for 2 consecutive days B.Sc. First year practical includes studies of growth of microorganisms and life activities of Microorganisms. These studies need two consecutive days for completion of practical.)

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1. Microscopy- Different parts of compound microscope. Use and care of compound microscope
2. Construction, Operation and utility of laboratory Equipments. (any Six)
  - a. Autoclave
  - b. Hot air oven
  - c. Incubator
  - d. pH meter
  - e. High speed centrifuge
  - f. Colorimeter/Spectrophotometer
  - g. Anaerobic jar
  - h. Bacterial filters
  - i. Laminar air flow
3. Staining
  - a. Simple staining: Monochrome, Negative
  - b. Differential : Gram's staining
  - c. Structural staining:
    - i. Cell wall staining ( Chance's method )
    - ii. PHB staining (Burdon's method.)
4. Hanging drop technique.
5. Micrometry
6. Preparation of culture media
  - a. Nutrient broth and Agar
  - b. MacConkey's Broth and Agar
  - c. Sugar Media
7. Isolation of bacteria from mixed culture
  - a. Streak plate method
  - b. Spread plate method
  - c. Pour plate method
8. Effect of physical and chemical agents on growth of bacteria
  - a. pH
  - b. Temperature
  - c. U.V. rays
  - d. Antibiotics
9. Qualitative tests for
  - a. Carbohydrates: Benedict's test
  - b. Protein: Biuret test
  - c. Nucleic acid: Diphenylamine test (DPA) for DNA and Orcinol test for RNA.
10. Demonstration of Yeast, Fungi, Actinomycetes, Algae and Protozoa.
11. Study of Bacterial Growth curve.

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**Faculty of Science and Technology**  
**Subject: Microbiology**  
**B. Sc. First Year (Semester – I & II)**  
**Paper Name: Practical's based on Section A & Section B of CCMB**  
**I & CCMB II ( PV)**  
**Paper Number: V**  
**PROFORMA FOR PRACTICAL EXAMINATION**

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**Time: Four hours per day per batch for two consecutive days**

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**Marks: 80**

<b>1. Isolation of Bacteria</b>		<b>20</b>
OR		
Study of growth curve		
Approach	- 04	
Requirements	- 03	
Procedure	- 02	
Technique	- 05	
Result and Observation	- 03	
Conclusion	- 02	
Viva Voce	- 01	
<b>2. Staining (Any One)</b>		<b>15</b>
Approach	- 04	
Requirements	- 02	
Procedure	- 02	
Technique	- 03	
Result and Observation	- 02	
Viva Voce	- 02	
<b>3. Hanging drop technique / Micrometry / Medium Preparation</b>		<b>15</b>
Approach	- 04	
Requirements	- 02	
Procedure	- 02	
Technique	- 02	
Result and Observation Conclusion	- 03	
Viva Voce	- 02	



<b>4.</b>	a) Effect of pH/Temperature/U.V. Radiation/ Heavy metals	10
	Approach	- 04
	Requirement	- 02
	Procedure	- 02
	Result and Observation Conclusion Viva	- 02
	b) Biochemical tests	05
	(Carbohydrate/Protein/NA)	
	Procedure	- 03
	Result and Observation Conclusion Viva	- 02
<b>5.</b>	Spotting	15
	<b>i.</b> Parts of microscope/Instruments	
	<b>ii.</b> Stain	
	<b>iii.</b> Nutrient media	
	<b>iv.</b> Permanent slide of Algae/Fungi/Protozoa/Actinomycetes	
	<b>v.</b> Technique	