

**Rayat Shikshan Sanstha's**

**YASHAVANTRAO CHAVAN INSTITUTE OF  
SCIENCE, SATARA  
(AUTONOMOUS)**

**Reaccredited by NAAC with 'A+' Grade**

**Proposed Syllabus For**

**Bachelor of Science**

**Part - II**

**MICROBIOLOGY**

Syllabus to be implemented w .e. f. June, 2019

## Structure of the course :

## 1] Semester III (No. Of Papers - 02)

Sr. No	Subject title	Theory				Practical		
		Paper No. & Paper code	Title of paper	No. of lectures per week	Credits	No. of lectures per week	Credits	
1.	Microbiology	Paper V BMiT 301	Microbial physiology & Metabolism	6	4	practical III BMiP 303	8	4
		Paper VI BMiT 302	Applied Microbiology	6	4			

## 2] Semester IV (No. Of Papers-02)

Sr. No	Subject title	Theory				Practical		
		Paper No. & Paper code	Title of paper	No. of lectures per week	Credits	No. of lectures per week	Credits	
1.	Microbiology	Paper VII BMiT 401	Microbial genetics and Molecular biology	6	4	Practical IV BMiP 403	8	4
		Paper VIII BMiT 402	Basics in medical microbiology & Immunology	6	4			

**Structure and titles of the papers of B.Sc. II course  
Semester III**

Code	Name of Paper	Units
BMiT 301	<b>Microbial Physiology And Metabolism</b>  (CREDITS:04 ; TOTAL HOURS : 45)	<b>Unit I:</b> Effect of Environment on Microbial Growth <b>Unit II:</b> Nutrient uptake and Transport <b>Unit III :</b> Chemo heterotrophic Metabolism- Aerobic Respiration <b>Unit IV :</b> Metabolism , anaerobic respiration and fermentation
BMiT 302	<b>Applied Microbiology</b> (CREDITS:04 ; TOTAL HOURS : 45)	<b>Unit I:</b> Water Microbiology <b>Unit II:</b> Milk Microbiology <b>Unit III :</b> Sewage Microbiology <b>Unit IV :</b> Industrial Microbiology

**Semester IV**

BMiT 401	Microbial Genetics & Molecular Biology (CREDITS:04 ; TOTAL HOURS : 45)	<b>Unit I:</b> Basic concepts of Genetics <b>Unit II:</b> Molecular Biology <b>Unit III:</b> Mutations <b>Unit IV:</b> Regulation of gene expression
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Semester –



**Practicals**

<b>Code</b>	<b>Name of Paper</b>
<b>Semester III</b> BMiP 303	Microbiology practical III (CREDITS : 04)
<b>Semester IV</b> BMiP 403	Microbiology practical IV (CREDITS : 04)

**Semester – III**  
**Paper–V BMiT 301**  
**MICROBIAL PHYSIOLOGY AND METABOLISM**  
**(CREDITS: 04; TOTAL HOURS: 45)**

**Learning Objectives: The students should be able to**

1. Understand different environmental factors influencing microbial growth.
2. Know the transport mechanism in bacterial cells.
3. Learn various energy yielding pathway in microorganisms.
4. Understand aerobic and an aerobic respiration.

**Unit - I: Effect of Environment on Microbial Growth [11]**

Microbial growth in response to environment

- A] Temperature (psychrophiles, mesophiles, thermophiles, extremophiles, thermotolerants, psychrotrophs) Thermal destruction of bacteria - D, F, Z value TDP and TDT
- B] pH (acidophiles, alkalophiles), solute and water activity (halophiles, xerophiles, osmophilic)
- C] Oxygen (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe)
- D] Osmotic pressure - isotonic, hypertonic, hypotonic environment, xerophiles, halophiles
- E] Diauxic growth - Effect of simple and complex sugars on growth (glucose and lactose)

**Unit - II: Nutrient uptake and Transport [11]**

- A] Transport proteins - properties of transport proteins, Structure and function of membrane Transport proteins.
- B] Passive and facilitated diffusion ii) Primary and secondary active transport, concept of uniport, symport and antiport
- C] Group translocation,
- D] Iron uptake

**Unit - III: Chemo heterotrophic Metabolism - Aerobic Respiration [12]**

- A] Concept of free energy, High energy compounds.
- B] Concept of aerobic respiration, anaerobic respiration and fermentation.
- C] Sugar degradation pathways i.e. EMP, TCA cycle.
- D] Electron transport chain: components of respiratory chain, comparison of mitochondrial and bacterial ETC.

**Unit - IV: Chemo heterotrophic Metabolism - Anaerobic Respiration and fermentation [11]**

- A] Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate / nitrite respiration)
- B] Fermentation - Alcohol fermentation and Pasteur effect; Lactate fermentation (homofermentative and heterofermentative pathways)

**Learning outcomes****Unit - I: Students will be able to**

1. Know the types of microorganisms growing in different extreme environmental conditions and the effect of environmental factors on microbial growth

**Unit - II: Students will be able to**

1. Know the transport of nutrients and role of siderophores in iron uptake in microorganisms

**Unit - III: Students will be able to**

1. Understand the concept of free energy, free energy change, endergonic and exergonic reactions, concept of coupled reactions.

**Unit - IV: Students will be able to**

1. Know the pathways of sugar degradation and bioenergetics of these pathways.
2. Know the difference between aerobic, anaerobic respiration and fermentation.

**References**

1. Microbiology - An introduction, Tortora, Funke, Pearson education, 8<sup>th</sup> edition., 2008 (Unit - I, Unit - III)
2. Lehninger Principles of Biochemistry, David L. Nelson, Michael M.Cox, York : W.H. Freeman, 5<sup>th</sup> ed. New 2008. (Unit - II)
3. Microbiology - Pelczar M. J., Chan ECS, Krieg NR, McGraw Hill book company, 5<sup>th</sup> edition. 1993.
4. Microbiology, Prescott, Harley, Klein's, J.M. Willey, L.M. Sherwood, C.J. Woolverton, Mc Graw Hill, 7<sup>th</sup> edition, 2008.
5. General Microbiology Vol I. Powar & Dagainawala, Himalaya publishing house, 2<sup>nd</sup> edition, 2010. (Unit - II, Unit - III and - IV)
6. Brock Biology of Microorganisms, Martinko, Dunlap, Madigan, Clark, Pearson International, 12<sup>th</sup> edition. 2010 ( Unit - I, Unit - II, Unit - III, Unit - IV)
7. Principles of Microbiology - Ronald M. Atlas McGraw Hill Education, 2<sup>nd</sup> edition, 1997 ( Unit - I, Unit - II, Unit - III, Unit - IV)

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**Paper - VI BMiT302**  
**Applied Microbiology**  
**(CREDITS: 04; TOTAL HOURS: 45)**

**Learning Objectives: The students should be able to**

1. Know the basic concepts of water, milk and sewage microbiology
2. understand concepts of routine bacteriological analysis of water and milk
3. understand composition of milk, sources of contamination and methods of Pasteurization
4. learn basic concept of fermentation, fermentor design, fermentation media, factors affecting fermentation process
5. learn about primary and secondary screening procedures

**Unit - I: Water Microbiology**

**[11]**

- A] Natural waters, aquatic environment and factors affecting kinds of microorganisms in it viz. temperature, hydrostatic pressure, light, salinity, turbidity, pH, nutrients.
- B] Drinking water and sources of its contamination.
- C] Fecal pollution of water, Indicators of fecal pollution of water –*E.coli*.
- D] Routine Bacteriological analysis of water.
  - a] SPC
  - b] Tests for coliforms - Qualitative tests
    - i] Presumptive test
    - ii] Confirmed Test
    - iii] Completed test
  - c] Differentiation between coliforms
    - i] IMViC test
    - ii] Eijkman test
  - d] Enumeration of coliforms - Quantitative tests
    - i] MPN
    - ii] Membrane filter technique
- E] Municipal water purification process and its significance.

**Unit - II : Milk Microbiology**

**[11]**

- A] Sources of microorganisms in milk
- B] General composition of Milk.
- C] Microbiological examination of Milk - DMC, SPC and dye reduction test - MBRTtest
- D] Pasteurization - Definition, Methods - LTH, HTST, UHT,
- E] Efficiency of Pasteurization - Phosphatase test (Qualitative)



**Unit - III: Sewage Microbiology****[11]**

- 1] Sewage Microbiology
- A] Definition
- B] Types
- C] Chemical characteristics
- D] Microflora
- E] BOD and COD- Definitions, Basic concept
- F] Treatment and disposal
  - a. Small scale treatment
  - b. large scale treatment
- i] Primary treatment
- j] Secondary treatment
- ii] Final treatment

**Unit - IV: Industrial Microbiology****[12]**

- A] Fermentation Definition, Screening - Primary and secondary screening
- B] Fermentations media- Water, carbon source, nitrogen source, precursors, growth factors , antifoam agents & chelating agents
- C] Types of fermentations – Batch, continuous, dual and multiple
- D] Typical Fermenter design – Parts and their functions
- E] Factors affecting fermentation process
- F] Concept of primary and secondary metabolites

**Learning outcomes****Unit - I: Students will be able to**

1. To know different types of aquatic environments, microorganisms in it and factors affecting the growth of organisms.
2. Understand sources of contamination of water.
3. Understand the principles for routine bacteriological analysis of water. and the significance of municipal water purification process.

**Unit - II: Students will be able to**

1. Know about methods of pasteurization
2. Know the concepts of water, milk microbiology

**Unit - III: Students will be able to**

1. Know basic concept of sewage microbiology and treatment and disposal of sewage.

**Unit - IV: Students will be able to**

1. Know basic concept of fermentation, fermenter design, fermentation media, and factors affecting fermentation process.
2. Understand types of fermentations, primary and secondary metabolites.

**References**

- a. Industrial microbiology - A. H. Patel, Macmillan, 2<sup>nd</sup> edition, (1984) (Unit - IV)
- b. Industrial microbiology - L.E. Casida, J.R. New Age International publisher, 2<sup>nd</sup> edi, 2007 (Unit - IV)
- c. Dairy Microbiology - Dr. K.C. Mahanta, Omsons publications, 1997 (Unit - II)
- d. Industrial microbiology - Miller and Litsky Mcgraw-Hill publications, 1976 (Unit -IV)
- e. A Text book of Microbiology - R. Dubey, D. K. Maneshwari, S. Chand Co. Ltd. Ramnagar New Delhi, 2013. (Unit - III)
- f. Fundamentals of Microbiology - Frobisher etal Thomson Learning; 9<sup>th</sup> revised edition, 1974.

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**BMiP303**  
**Microbiology Practical - III**  
**(CREDITS: 04)**

**Learning Objectives: Student should be able to**

1. Understand the effect of various environmental factors on growth of microorganisms.
2. Study diauxic growth pattern of *E.coli*.
3. Learn about oxidative and fermentative metabolism of sugars.
4. Understand the technique for routine bacteriological analysis of water.
5. Learn methods of screening.

**Practicals**

**A. Effect of environmental factors on microorganisms:**

1. Temperature.
2. pH.
3. Salt (NaCl).
4. Determination of thermal death time of given bacterial culture.
5. Determination of decimal reduction time of *E.coli*.
6. Study of diauxic growth of *E.coli*.

**B. Biochemical tests**

7. HL test
8. Nitrate reduction test
9. Oxidase test

**C. Preparation of microbiological media**

10. HL medium
11. Peptone nitrate broth

**D. Bacteriological analysis of water****a. Qualitative tests**

12. Presumptive
13. Confirmed
14. Completed
15. IMViC test

**b. Quantitative tests**

16. MPN

**E. Bacteriological Analysis of Milk**

17. MBRT test
18. Phosphatase test

**F. Primary Screening of**

21. Antibiotic producers - crowded plate technique
22. Amylase producers
23. Alcohol fermentation - Demonstration

**Learning outcomes : Students will be able to**

1. Learn the effect of environmental factors - temperature, pH, salt on microbial growth.
2. Understand the significance of TDT, and decimal reduction time.
3. Learn the growth pattern of bacteria when two sugars are present in the growth medium.
4. Learn about oxidative and fermentative metabolism of sugars
5. Prepare different culture media
6. Know the significance of media components.
7. Understand the technique for routine Bacteriological analysis of water.
8. Learn about methods of screening

**Practical references**

1. Microbiology in action by J. Heritage, E. G. V. Evans and R.A. Killington Cambridge University press, 1<sup>st</sup> edition, 1999.
2. Practical Microbiology laboratory manual by B. Senthil Kumar, Zothansanga, Panima publishing corp (2014).

3. Experimental microbiology by Rakesh Patel, Vol I, Aditya book, 5<sup>th</sup> edition, 2009.
4. Experimental microbiology by Rakesh Patel, Vol II
5. Basic and Practical Microbiology - Atlas, Macmillan Pub Co, 1986.
6. Handbook of Bacteriological techniques F.J. Baker, Butter worth publications, 2<sup>nd</sup>ed.,
7. Laboratory Fundamentals of Microbiology - Alcamo, I.E, Benjamin / Cummings publishing company, 2004.
8. Media preparation - High media manual, 2<sup>nd</sup> edition.

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**SEMESTER - IV**  
**Paper VII BMiT 401**  
**Microbial Genetics & Molecular Biology**  
**(CREDITS : 04; TOTAL HOURS : 45)**

**Learning Objectives : The students should be able to**

1. Understand basic concepts of genetics w.r.t. various definitions.
2. Know different forms of DNA, types of mutations, mode of action of mutagenic agents and DNA repair.
3. Know modes of gene transfer in bacteria.
4. Know about properties, types and applications of plasmids.
5. Know concept of operon, regulation of Lac operon.

**Unit - I : Basic concepts of Genetics** **[11]**

- A] Definitions - Gene, genome, genotype, phenotype, mutagen, recon, muton, cistron, Split genes.
- B] Forms of DNA- A, B, C, D, Z, Chargaff's rule
- C] Genetic code – definition and properties of genetic code.

**Unit - II : Molecular Biology** **[11]**

- A] Gene transfer in bacteria.
- a] Fate of exogenote in recipient cell.
- b] Modes of gene transfer - Transformation, Conjugation, Transduction
- B] Plasmids.
- a] Natural- Properties, types F plasmid, R plasmid, Col plasmid, Ti plasmid, Metabolic plasmid, structure and applications.
- b] Artificial - pBR 322 - structure and applications.

**Unit - III : Mutations****[12]**

- A] Basic Concepts, definitions- Missense, nonsense, neutral, silent, pleiotropic and suppressor mutations.
- B] Types of Mutation :
  - a] Spontaneous mutation - Definition and basic concept
  - b] Induced mutations
    - 1] Physical and chemical mutagens
    - 2] Mechanism of mutagenesis by physical and chemical mutagens
  - i] Base analogues : 5 - Bromouracil and 2 - aminopurine
  - i] Mutagens modifying nitrogen bases - Nitrous acid, Hydroxyl amine, Alkylating agents
  - iii] Mutagens that distort DNA
    - a] Acridine dyes
    - b] UV light
- C] DNA repair mechanisms - Photo reactivation, Excision repair

**Unit - IV : Regulation of gene expression****[11]**

- A] Overview of regulation - Major modes of regulation.
- B] DNA binding proteins and regulation of transcription.
- C] Enzyme repression and induction Inducers and corepressor.
- D] Operon model- e.g. Lac operon.

**Learning outcomes****Unit - I : Student will be able to**

1. Understand the concept of genetics, genetic code.

**Unit - II : Student will be able to**

1. Understand modes of gene transfer in bacteria.

**Unit - III : Student will be able to**

1. Know about mutation and different types of mutations and DNA repair mechanisms.

**Unit - IV : Student will be able to**

1. Understand concept of operon, regulation of Lac operon.

**References**

1. General Microbiology - R.Y. Stainer, Macmillan and Co (1111), 5<sup>th</sup>ed, 1999 (Unit -I, Unit - II, Unit - III)

2. Genetics. Monroe W. Stickberger, Mac Millan publication, 3<sup>rd</sup> edn. 1985 (Unit - III, Unit - IV)
3. Lehninger Principles of Biochemistry, David L. Nelson, Michael M. Cox, New York: W.H. Freeman, 5<sup>th</sup>ed., 2008 (Unit - IV)
4. Biochemistry by U. Satyanarayana and U. Chakrapani., 4<sup>th</sup> edition, 2004. (Unit - IV)
5. Concept of Genetics, Klug and Cummings, Pearson Education publications, 11<sup>th</sup> edition, 2014. ( Unit - II, Unit - IV)
6. Gardner EJ, Simmons MJ, Snustad DP, Principles of Genetics, Wiley - India., 8<sup>th</sup> edition, (2008). (Unit - IV)
7. Microbial Genetics Maloy SR, Cronan JE and Friefelder D, Jones and Barlett publishers, 2<sup>nd</sup> Edition, (2004) ( Unit - I, Unit - IV)
8. Brock biology of Micro organisms Madigan, Martinko, Dunlap, Clark, Pearson International Publication, 12<sup>th</sup> edition, 2010. (Unit - IV)

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**Paper – VIII BMiT 402**  
**Basics in Medical Microbiology and Immunology**  
**(CREDITS : 04; TOTAL HOURS : 45)**

**Learning Objectives : The students should be able to**

1. Know the basic concepts and terms used in medical microbiology.
2. Understand types of infections, modes of transmission and process of disease production.
3. Know about general principle of cultivation of disease producing organisms and concepts of prevention and control of diseases.
4. Learn defence mechanisms of host.
5. Learn about antigen, antibody definition, types and reactions.

**Unit - I : Host Pathogen Interaction****[11]**

- A] Definitions : Host, Parasite, Commensal, etiological agent, Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Signs of disease, symptoms, syndrome, sequelae infections, fomite.
- B] Classification of disease : Occurrence ( Epidemic, Endemic, Pandemic, Sporadic), severity or duration ( Acute, Chronic ), Extent of host involvement, Infectious (Communicable), non infectious (Non communicable).
- C] Types of Infections : Opportunistic infections, Nosocomial infections, Primary, Reinfection, secondary, focal, Cross, Iatrogenic, Inapparent, Latent, Inherited, congenital, Local, Generalised, Covert, overt, Simple, Mixed, Pyogenic
- D] Sources of infection : Exogenous and Endogenous ( Patient, Carrier : types of carrier, Animals, insects, soil, water, food, Reservoirs of infection)
- E] Modes of Transmission of disease :
1. Transmission by air, water and food
  2. Contact transmission
  3. Vector borne transmission
- F] Disease Process :
- Portal of entry and Exit of Organisms
- Virulence : Adherence, Attachment, colonization, Invasiveness, Enzymes and Toxin produced, Cell structures Viz. Cell wall, Capsule.

**Unit - II : Infection and Disease****[12]**

- A] Laboratory Diagnosis : Sample collection , transport, culturing of clinical samples
- B] Causative agent , spread, pathogenesis, symptoms, microbiological diagnosis,

- prevention and control of Enteric fever , UTI caused by *Proteus*  
C] General principles of prevention and control of microbial diseases

**Unit - III : Host defence mechanism [11]**

- A] Types of Immunity : Active and Passive  
B] First line of defence : Physical, Chemical and Cellular mechanism  
C] Second line of defence: Inflammation and fever: Anti microbial substances present in blood and tissue fluids, Phagocytic cells and phagocytosis.  
D] Third line of defence (Specific defence mechanism) –Antibody mediated and cell mediated immunity ( activation of resting B lymphocytes to effector cells, Activation of Tc cells and mechanism of Killing by CD 8 cells

**Unit - IV : Antigen and Antibodies [11]**

- a] Antigens : Nature, types, factors affecting antigenicity.  
b] Antibodies : Structure, Properties and Types.  
c] Primary and Secondary immune response.  
d] Antigen – Antibody reactions - Basic concepts of precipitation and agglutination.

**Learning outcomes****Unit - I : Student will be able to**

1. Classify various diseases and understand modes of disease transmissions.

**Unit - II : Student will be able to**

1. Understand the principles of diagnosis, prevention and control of disease.

**Unit - III: Student will be able to**

1. Know defence mechanisms of human host.

**Unit - IV : Student will be able to**

1. Understand concept of antigen - antibody types and reactions.

**References**

1. Text book of Microbiology Ananthnarayan and Paniker's by R. Ananthnarayan Orient Blackswan publications, 10<sup>th</sup> edition, 2006 ( Unit - I , Unit - II Unit - III, Unit - IV)
2. Microbiology : An Introduction : Tortora, Funke, Case : Pearson Education publication, 12<sup>th</sup> Edi. 2016 ( Unit - I, Unit - II, Unit - III, Unit - IV)
3. Microbiology : Jacquelyn G. Black. International student version, Wiley publication, 8<sup>th</sup> Edition 2012. ( Unit - I, Unit - II, Unit - III)
4. Zinsser's Microbiology – by Wolfgang K. Joklik, Appleton and Lange, 20<sup>th</sup>



- edition, 1992 (Unit - I, Unit - III)
5. Medical Bacteriology, Dey, N. C. and Dey, T. K, Allied Agency, Calcutta. 17<sup>th</sup> edition, 1988 (Unit - II)
  6. Text book of Preventive and social medicine by K. Park, Bhanot publications 23<sup>rd</sup> edition, 2015. (Unit - II)
  7. Basic experimental microbiology by Ronald Atlas, Robert Brown, Bonus Miller – Pren - Tice Hall, 1986 (Unit - II)
  8. Immunology by Fatima, Saras publication, 2014. (Unit - I, Unit - III).

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**BMiP- 403**  
**Microbiology practicals – IV**  
**(CREDITS : 04)**

**Learning objectives : Student should be able to**

1. Carry out isolation of lac negative mutants of *E.coli*.
2. Prepare different microbiological media and know the mechanism of different biochemical tests.
3. Isolate *Salmonella* & *Proteus Spp* from clinical sample.
4. Detect presence of antibody against *Salmonella spp* in serum sample by qualitative widal test.
5. Know the mechanism of RPR test.

**Practicals**

1. Isolation of lac negative mutants of *E.coli* by visual detection method.
2. Effect of U.V. light on growth of bacteria.

**Preparation of Microbiological media**

3. Peptone water.
4. Sugar fermentation medium - Glucose, Mannitol.
5. Simmon's citrate agar slant.
6. Glucose phosphate broth.
7. Wilson and Blairs medium.
8. Christensen's urea agar.
9. phenylalanine deamination medium.
10. Gelatin agar.
11. Selenite F broth.
12. Tetrathionate broth.
13. Isolation of causative agent of enteric fever : *Salmonella*.
14. Isolation of causative agent of urinary tract infection : *Proteus*.
15. Serological diagnosis of Enteric fever: Widal test (Qualitative).
16. Agglutination test : Blood group detection.
17. RPR test.
18. Phenyl alanine deamination test.
19. Urea hydrolysis test
20. Gelatin hydrolysis test

**Learning outcomes : Students should be able to**

1. Able to learn technique of isolation of lac negative mutants of *E.coli*
2. Able to understand Effect of U.V. light on growth of bacteria
3. Isolate *Salmonella* & *Proteus spp* from clinical sample
4. Detect presence of antibody against *Salmonella spp* in serum sample by qualitative widal test
5. Know the mechanism of RPR test
6. Determine the blood group.

**Practical references :**

1. Microbiology in action by J. Heritage, E. G. V. Evans and R.A. Killington cambridge university press, 1<sup>st</sup> edition, 1999.
2. Practical Microbiology laboratory manual by B .Senthil Kumar, Zothansanga, Panima publishing corp (2014)
3. Experimental microbiology by Rakesh Patel, Vol I, Aditya book, 5<sup>th</sup> edition, 2009.
4. Experimental microbiology by Rakesh Patel, Vol - II
5. Basic and Practical Microbiology - Atlas, Macmillan Pub Co, 1986.
6. Handbook of Bacteriological techniques F.J. Baker, Butterworth publications, 2<sup>nd</sup>ed.,
7. Laboratory Fundamentals of Microbiology – Alcamo, I.E, Benjamin / Cummings publishing company, 2004.
8. Media preparation - High media manual, 2<sup>nd</sup> edition.

### Equivalence in accordance with titles and content of papers

Proposed syllabus for YCIS, Satara (autonomous)		Syllabus for Shivaji university	
Paper No.	Titles of the paper	Paper No.	Titles of the paper
V	Microbial physiology and metabolism 4 units= 45 lectures	V	Microbial Physiology & Metabolism 2 units= 30 lectures
VI	Applied Microbiology 4 units= 45 lectures	VI	Applied Microbiology 2 units= 30 lectures
VII	Microbial Genetics & Molecular Biology 4 units= 45 lectures	VII	Microbial Genetics & Molecular Biology 2 units= 30 lectures
VIII	Basics in Medical Microbiology and Immunology 4 units= 45 lectures	VIII	Basics in Medical Microbiology & Immunology 2 units= 30 lectures
Total No. of practicals= 43		Total No. of practicals= 35	