

**GUJARAT VIDYAPEETH : AHMEDABAD**

**M.D. Gramseva Mahavidyalaya, Sadra,**

**Dist: Gandhinagar**

**Department of Microbiology**

**Semester-V**

**(In Force from June-2012)**

**GUJARAT VIDYAPEETH : AHMEDABAD**

**M.D. Gramseva Mahavidyalaya, Sadra, Dist: Gandhinagar  
Department of Microbiology**

**Semester-V**

**(In Force from June-2012)**

**MIC-501- Introduction to Bacterial Genetics-1**

**(Syllabus of theoretical portion) (In force from June, 2010)**

**Total Mark: 50= External Evaluation: 40 Marks +**

**Internal Evaluation: 10Marks)**

**(Total Teaching Hours=30, Credit=02)**

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<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>1</b>	i. Principles of inheritance - relevance of Mendelian laws	<b>2</b>
	ii. Nature of genetic material: gene structure and function, arrangement and linkage, gene complementation, cistron, concept of intron and exon, one gene one polypeptide theory, structures of DNA, organization of bacterial chromosome. Microorganisms as genetic tools	<b>6</b>
<b>2</b>	i. Experiments to prove NA as inheritance material	<b>2</b>
	ii. Semi-conservative mode of chromosome replication, work of Messelson and Stahl	<b>1</b>
	iii. Molecular mechanism of chromosome replication, origin of replication, mode of formation of replication fork and its growth, post-replicative modification of DNA	<b>3</b>
	iv. Models of chromosome replication- Cairn's model and Rolling circle model	<b>1</b>
<b>3</b>	i. Concept of central dogma and its exceptions	<b>1</b>
	ii. Gene transcription as the 1 <sup>st</sup> step of gene expression, molecular mechanism of transcription, role of RNA polymerase, initiation, elongation and termination of RNA synthesis, post transcriptional modifications in bacteria	<b>2</b>
	iii. Nature of Genetic code - characteristics of genetic code - triplet, degeneracy, Wobble Hypothesis. Deciphering genetic code, work of Nirenburg, Holley and Khorana	<b>2</b>
	iv. Type of RNAs involved in protein synthesis, structure and function of RNA	<b>1</b>
<b>4</b>	i. <u>Gene translation</u> : Ribosome- their general nature, structure and role in protein synthesis	<b>1</b>
	ii. Initiation, elongation and termination of protein synthesis, post translational processing	<b>2</b>
	iii. Protein localization- export of protein, role of signal peptides	<b>2</b>
	iv. <u>Regulation of Gene expression</u> :	<b>2</b>
	v. Lac operon (positive & negative control),	<b>2</b>
	vi. Tryptophan operon (Attenuation control)	<b>2</b>

**References:**

1. Microbiology, (5<sup>th</sup> Ed.) – Prescott
2. Microbiology, (2<sup>nd</sup> Ed.) – R.M. Atlas
3. Microbiology, (3<sup>rd</sup> Ed.) - Tortora
4. Genes VIII, -Benjamin Lewin
5. Molecular Genetics of Bacteria (2<sup>nd</sup> Ed.) - Snyder
6. Molecular Biology of the Gene (5<sup>th</sup> Ed.) -J. D. Watson

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**MIC-501- Introduction to Bacterial Genetics-1**

**(Syllabus of PRACTICAL portion)**

**Total Mark: 25= External Evaluation: 20 Marks +**

**Internal Evaluation: 05Marks)**

**(Total LAB Hours=45, Credit=02)**

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- 1 Isolation of pigmentation mutants of *S. marsencence* by U.V. mutagen
- 2 Isolation of resistant mutant by gradient plate technique
- 3 Isolation of DNA from *S. cerevisiae*

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(In Force from June-2012)

**MIC-502- Introduction to Bacterial Genetics-2**

(Syllabus of theoretical portion) (In force from June, 2010)

Total Mark: 50= External Evaluation: 40 Marks +

Internal Evaluation: 10Marks)

(Total Teaching Hours=30, Credit=02)

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<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>1</b>	i. Nature of mutation: spontaneous and inducible mutation	<b>1</b>
	ii. Phenotypic classes of bacterial Mutants and Genotypic classes of bacterial Mutants	<b>1</b>
	iii. Mutation rate & Mutagenesis(physical, oxidative deaminating agents, base analogues, intercalating agents, alkylating agents, Mu phage)	<b>5</b>
<b>2</b>	i. Methods for the isolation of auxotrophic mutants, phenomic and phenotypic lag	<b>2</b>
	ii. Reversion of mutation- true reversion and suppression, types of suppressor mutations	<b>3</b>
	iii. DNA repair- direct and indirect repair mechanisms and recombination repair	<b>3</b>
<b>3</b>	i. Introduction to genetic recombination and its biological significance: Types of recombination and their molecular mechanisms - generalized, site specific and illegitimate recombination, recombination frequency and its significance	<b>4</b>
	ii. Modes of genetic transfer in bacteria- merodiploidic nature of bacterial zygote	<b>1</b>
	iii. Plasmids and transposable elements	<b>3</b>
<b>4</b>	i. Transformation: transformation principle, competence factor, mechanisms of DNA uptake, transfection	<b>2</b>
	ii. Transduction: phages involved in, types- restricted, generalized and abortive transduction	<b>2</b>
	iii. Conjugation: role of sex factor, types of crosses involved, F <sup>+</sup> and Hfr cells. Mechanisms of chromosomal transfer interrupted mating and its applications, Zygotic induction, sex-duction	<b>3</b>

**References:**

1. Microbiology, (5<sup>th</sup> Ed.) – Prescott
2. Microbiology, (2<sup>nd</sup> Ed.) – R.M. Atlas
3. Microbiology, (3<sup>rd</sup> Ed.) - Tortora
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**(In Force from June-2012)**  
**MIC-502- Introduction to Bacterial Genetics-2**  
**(Syllabus of PRACTICAL portion)**  
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- 1 Study of spontaneous nature of bacterial mutations using Replica plate technique

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**MIC-503- : Bacterial Metabolism-1**  
(Syllabus of theoretical portion) (In force from June, 2010)  
Total Mark: 50= External Evaluation: 40 Marks +  
Internal Evaluation: 10Marks)  
(Total Teaching Hours=30, Credit=02)

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**UNIT : 1. MODES OF ENERGY GENERATION (1)**

- 1. The laws of thermodynamics (08 HOURS)  
(01 lecture)
- 2. Free energy change, standard free energy change, Exothermic and Endothermic reactions (01 lecture)
- 3. High energy compounds, their types and role in metabolism (01 lecture)
- 4. Modes of ATP production (06 lectures)
- A. Substrate level phosphorylation (01 lecture)
- B. Electron transport chain: In chemotrophs and phototrophs (01 lecture)

**UNIT : 2 MODES OF ENERGY GENERATION (02) (07 HOURS)**

- a. Components of Electron transport chain, their arrangements and their Role in generation of PMF, Chemiosis ATPoPhosphohydrolase, Inhibitors and uncouplers, Anaerobic respiration. (03 lectures)
- b. Fermentation (01 lecture)
- c. Aerobic Respiration (01 lecture)
- d. Photosynthesis. (02 lectures)

**UNIT : 3. CHEMOHETEROTROPHIC, CHEMOAUTOTROPHIC AND PHOTOTROPHIC METABOLISM (A) (10 HOURS)**

- A. Utilizable substrates: Carbohydrates, Lipids, Aromatic Hydrocarbons and Proteins, Role of reducing power and Precursor Metabolites (04 lectures)
- B. Catabolism of Glucose: Glycolysis, ED Pathway, Pentose Phosphate Pathway, Fate of Pyruvate under aerobic as well as anaerobic conditions. (06 lectures)
- C. Aromatic Hydrocarbons Catabolism (01 lecture)

**UNIT : 4. CHEMOHETEROTROPHIC, CHEMOAUTOTROPHIC AND PHOTOTROPHIC METABOLISM (B) (05 HOURS)**

- A. Beta oxidation of fatty acids (01 lecture)
- B. Catabolism of Proteins and Amino acids: Deamination, Decarboxylation, Transamination and Decomposition, Stickland reactions (02 lectures)
- C. TCA Cycle: Catabolic and Anabolic role of TCA Cycle (02 lectures)
- D. Glyoxylate bypass and its significance.

**REFERENCE BOOKS OF PAPER BACTERIAL METABOLISM-1**

1. Microbiology, Pelzar, M.J. Chan, E.C.S., Krig N.R.: Mc Graw Hill Book Company
2. General microbiology, Stainer R.Y., Ingraham Wheelis, M.L. Painter, P.R. Mac Millan India.
3. Introduction to Microbiology by J.L. Ingraham and C.A. Ingraham, 2000
4. Microbiology by J.G. Black, 2002

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**(In Force from June-2012)**

**MIC-503- : BACTERIAL METABOLISM-1**

**(Syllabus of PRACTICAL portion)**

**Total Mark: 25= External Evaluation: 20 Marks +**

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- 1 Estimation of sugar by Cole's method
- 2 Estimation of sugar by Nelson's method
- 3 Estimation of protein by Folin's method

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**(In Force from June-2012)**

**MIC-504- Bacterial Metabolism—2**  
**(Syllabus of theoretical portion) (In force from June, 2010)**

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**Internal Evaluation: 10Marks)**

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**UNIT:1. CHEMOAUTOTROPHIC METABOLISM (07 HOURS)**

- A. Utilizable substrates: Hydrogen, CO<sub>2</sub>, Iron, Elemental S and Reduced S compounds, Role of ATP, Reducing Power and Precursor metabolites **(03 lectures)**
- B. General Properties of ecological significance of Nitrifying Bacteria, Hydrogen bacteria, S oxidizing bacteria and carboxy bacteria, Role of ETC in nitrifying bacteria **(04 lectures)**

**UNIT:2. PHOTOAUTOTROPHIC METABOLISM (08 HOURS)**

Phototrophic bacteria

1. Photosynthetic Apparatus in Photosynthetic Eubacteria
2. Photosynthetic pigments and their role in harvesting radiant energy.
3. Role of electron carrier molecules in generation of ATP by Photophosphorylation
4. Comparative Account of Plant and Bacterial Photosynthesis.

**UNIT:3. Biosynthesis of Building Blocks (08 HOURS)**

- A. Principles governing Biosynthesis **(01 lecture)**
- B. Biosynthesis of Building Blocks **(07 lectures)**
1. Role of Precursor metabolites in Biosynthesis of Building blocks
  2. Assimilation of Ammonia, Nitrate, Molecular Nitrogen and Sulphate reducing bacteria and its significance.
  3. Biosynthesis of Carbohydrates from non Carbohydrates substrates
    - Calvin`s Cycle, CO<sub>2</sub> pathway and Reductive TCA cycle in Atotrophs
    - Gluconeogenesis in Heterotrophs
  4. Role of Anaplerotic Reactions
  5. Biosynthesis of Saturated and Unsaturated Fattyacids



**UNIT:4. Biosynthesis of Macromolecules****(07 HOURS)****(07 lectures)**

Biosynthesis of Macromolecules.

1. Introduction to Polymerization

- AminoAcids into Polypeptide

- Nucleotides into Polynucleotide

- Fattyacids into Lipids

2. Biosynthesis of Phospholipids

3. Biosynthesis of Peptidoglycan

4. Methods of Studying Biosynthesis: Use of Biochemical Mutants, Isotopes,

Pulse Labbling and metabolic inhibitors.

**(03 lectures)****REFERENCE BOOKS**

1. Microbiology, Pelzar, M.J. Chan, E.C.S.,Krig N.R.: Mc Graw Hill Book Company
2. General microbiology, Stainer R.Y., Ingraham Wheelis, M.L.Painter, P.R. Mac Millan India.
3. Introduction to Microbiology by J.L. Ingraham and C.A. Ingraham, 2000
4. Microbiology by J,G, Black, 2002
5. Principles Of Biochemistry by Cohn and Stumph
6. Microbiology by Prescott , Harley, Klein 7<sup>th</sup> Edition , 2008, MacGraw Hill
7. Bacterial Metabolism by Gottschalk, 2<sup>nd</sup> Edition, 1<sup>st</sup> Indian reprint,2004, Springer.
8. Brock Biology of Microorganisms 11<sup>th</sup> Edition, 2006, by M.T. Madigan, Pearson prentice Hall.

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**MIC-504- BACTERIAL METABOLISM—2**

**(Syllabus of PRACTICAL portion)**

**Total Mark: 25= External Evaluation: 20 Marks +**

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- 1 Qualitative analysis of proteins
- 2 Qualitative analysis of carbohydrates
- 3 Separation of amino acid by chromatography technique

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**MIC-505- Genetic Engineering**

**(Syllabus of theoretical portion) (In force from June, 2010)**

**Total Mark: 50= External Evaluation: 40 Marks +**

**Internal Evaluation: 10Marks)**

**(Total Teaching Hours=30, Credit=02)**

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<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>1</b>	i. Introduction to genetic engineering, gene cloning and its ethical consideration ii. Outlines of rDNA technology and its application iii. Gene libraries - DNA sequencing, gene bank; screening gene libraries – nucleic acid hybridization, colony and plaque hybridization, immunological detection, gene probes, complementation of mutants	<b>1</b> <b>2</b> <b>4</b>
<b>2</b>	Tools of genetic engineering/rDNA technology Enzymes: restriction endonucleases, RNA polymerase, DNA ligase, alkaline phosphatase, polynucleotide kinase, reverse transcriptase Cloning vectors- plasmids, bacteriophages, cosmids, Ti, YEP	<b>4</b> <b>4</b>
<b>3</b>	i. Selection of genes based on – function, physical differences, complementary RNA, synthetic nucleotide primers ii. Isolating genes for known proteins, unknown gene products, chemical synthesis of genes, PCR, site – directed mutagenesis	<b>4</b> <b>4</b>
<b>4</b>	Genetic engineering of microorganisms (applications) – production of whole cells, SCP, small biological molecules (GA, citric acid, lactic acid, gluconic acid, glutamic acid, lysine, vitamins), alcohol, antibiotics, high molecular weight compounds (biopolymers, proteins and other products) Application in medicine – human proteins, recombinant vaccines, human vaccines Agriculture and environment – soil fertility, plant growth enhancement, insecticides, environmental pollution remediation	<b>3</b> <b>2</b> <b>2</b>

**References:**

1. Biotechnology – fundamentals and applications, (4<sup>th</sup> Ed.) – S. S. Purohit.
2. Molecular Biotechnology – Principles and practices – Channarayappa
3. Principles of Gene Manipulation – Old and Primrose, Blackwell scientific Publications
4. Molecular Biotechnology - Primrose

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**MIC-505- Genetic Engineering**  
**(Syllabus of PRACTICAL portion)**

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- 1 Conjugation,
- 2 Transformation
- 3 Recombination

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**Semester-V**  
**(In force from June-2012)**

**Paper No:- ENG-501**

**Paper Name:- English**

(Syllabus of theoretical portion)

**Total Marks: 50** (External evaluation : 40 marks)

(Internal evaluation : 10 marks)

**Credit :- 2**

Time duration:- 30 hours/Paper/Semester

**Unit-1 (Text) (35%)**

Fantasy a Collection of Short stories – Orient Blackswan,  
Edited by V. Sasikumar.

Lesson :

- (1) A service of love
- (2) The Thief
- (3) My brother, My Brother
- (4) The open Window
- (5) Day's Wait

**Unit-2 Vocabulary (15%)**

- (1) Match the words with their correct meaning.
- (2) Make meaningful sentences by using the words.
- (3) Use idiomatic phrase/expression in your sentences.

**Unit-3 Grammar (25%)**

- (1) Transformation (voice, speech) (Sentence base)
- (2) Tenses (application base) (paragraph)

**Unit-4 Comprehension (15%)**

- (1) Translation Eng. To Guj. (Paragraph)
- (2) Translation Guj. To Eng. (Sentence)
- (3) Complaint letter

**Unit-5 Composition (10%)**

Paragraph writing

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**Semester-V**  
**(In Force from June-2012)**  
**EC-501- Blood Banking**  
**(Syllabus of theoretical portion) (In force from June, 2010)**  
**Total Mark: 50= External Evaluation: 40 Marks +**  
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**(Total Teaching Hours=30, Credit=02)**

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<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>1</b>	i. Blood cells – general characters of RBC, WBC and platelets; production and maturation; haemoglobin	<b>4</b>
	ii. Haemostatis – role of blood vessels, role of platelets	<b>1</b>
	iii. Blood coagulation – factors, intrinsic and extrinsic pathway	<b>2</b>
<b>2</b>	i. Human blood group systems, principles of immunohematology	<b>4</b>
	ii. Blood collection – preparation for blood collection, criteria for the selection of donor, registration of donor and blood collection procedure	<b>4</b>
<b>3</b>	i. Transport and storage of blood – organization in storage, changes in stored blood, preparation and use of blood components	<b>6</b>
<b>4</b>	i. Significance of quality control in blood bank, specimen collection for blood bank, laboratory preparations in blood bank	<b>4</b>
	ii. Hemagglutination reactions – ABO grouping (slide and tube test), Rh blood typing (slide and tube test), Antihuman globulin (AHG) or Coombs test, compatibility testing (crossmatching) – major and minor, emergency crossmatching, Transfusion reactions and hemolytic disease of the newborn	<b>5</b>

**References:**

1. Introduction to Medical Laboratory Technology, (7<sup>th</sup> Ed.) – F. J. Baker, R. E. Silvertan, C. J. Pallister
2. Medical Laboratory Technology (Vol. I) – K .L. Mukherjee
3. Medical laboratory Technology – Godkar

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**(In Force from June-2012)**  
**EC-502- Starter Culture**  
**(Syllabus of theoretical portion) (In force from June, 2010)**  
**Total Mark: 50= External Evaluation: 40 Marks +**  
**Internal Evaluation: 10Marks)**  
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<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>1</b>	Lactic Acid Bacteria: Classification and Physiology; Bifidobacteria and Probiotic Action; The Probiotic Potential of Propionibacteria	<b>8</b>
<b>2</b>	Industrial Use and Production of Lactic Acid Bacteria; Antimicrobial Components from Lactic Acid Bacteria; Lactic Acid Bacteria as a Tool for Enhancing Food Safety by Removal of Dietary Toxins	<b>7</b>
<b>3</b>	Prebiotics and Lactic Acid Bacteria; Lactic Acid Bacteria in Vegetable Fermentations; Lactic Acid Bacteria in Cereal-Based Products	<b>7</b>
<b>4</b>	Human Studies on Probiotics; Safety of Novel Probiotic Bacteria; Lactic Acid Bacteria as Animal Probiotics; Lactic Acid Bacteria in Fish and Fish Farming; Future Directions of Research and Product Development of Lactic Acid Bacteria	<b>8</b>

**Reference:**

**Lactic Acid Bacteria Microbiological and Functional Aspects**, *Third Edition, Revised and Expanded*, edited by Seppo Salminen, Atte von Wright and Arthur Ouwehand, Marcel Dekker, Inc.

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**(In Force from June-2012)**  
**EC-503. Biodeterioration**  
**(Syllabus of theoretical portion) (In force from June, 2010)**  
**Total Mark: 50= External Evaluation: 40 Marks +**  
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<b>Uni t</b>	<b>Topics</b>	<b>Hours</b>
<b>1</b>	Biodeterioration of paper	<b>8</b>
<b>2</b>	Biodeterioration of wood	<b>7</b>
<b>3</b>	Biodeterioration of textile	<b>7</b>
<b>4</b>	Biodeterioration of lather	<b>8</b>

**References:**

1. Microbiology, (5<sup>th</sup> Ed.) – Prescott
2. Microbiology, (2<sup>nd</sup> Ed.) – R.M. Atlas
3. Microbiology, (3<sup>rd</sup> Ed.) – Tortora