

Paper No: 5
SEMESTER III
MICROBIAL PHYSIOLOGY AND METABOLISM

THEORY

MARKS: 100

Unit 1 Microbial Growth and Effect of Environment on Microbial Growth

No. of lectures: 8

- 1.1 Definitions of growth, Batch culture, Continuous culture, generation time and specific growth rate
- 1.2 Temperature and temperature ranges of growth
- 1.3 pH and pH ranges of growth
- 1.4 Effect of solute and water activity on growth
- 1.5 Effect of oxygen concentration on growth
- 1.6 Nutritional categories of microorganisms

(Chapter 6, Prescott, Harley and Klein's Microbiology by Willey JM, Sherwood LM and Woolverton CJ, 7th Ed., McGraw Hill Higher Education, 2008, Pages: 132-140)

(Chapter 7, General Microbiology by Stanier RY, Ingraham JL, Wheelis ML and Painter PR, 5th Ed., McMillan, 2005, Pages :183-186)

Unit 2 Nutrient uptake and Transport

No. of lectures : 8

- 2.1 Passive and facilitated diffusion
- 2.2 Primary and secondary active transport, concept of uniport, symport and antiport
- 2.3 Group translocation
- 2.4 Iron uptake

(Chapter 8, General Microbiology by Stanier RY, Ingraham JL, Wheelis ML and Painter PR, 5th Ed., McMillan, 2005, Pages 197-201)

Unit 3 Chemoheterotrophic Metabolism - Aerobic Respiration

No. of lectures : 14

- 3.1 Concept of aerobic respiration, anaerobic respiration and fermentation
- 3.2 Sugar degradation pathways i.e. EMP, ED, Pentose phosphate pathway
- 3.3 TCA cycle
- 3.4 Electron transport chain: components of respiratory chain, comparison of mitochondrial and bacterial ETC, electron transport phosphorylation, uncouplers and inhibitors

(Chapter 9, Prescott, Harley and Klein's Microbiology by Willey JM, Sherwood LM and Woolverton CJ, 7th Ed., McGraw Hill Higher Education, 2008, Pages: 194-200)

(Chapter 2, Microbial metabolism by Gottschalk G, 2nd Ed., Springer, 2011 (Reprint), Pages: 23-34)

Unit 4 Chemoheterotrophic Metabolism- Anaerobic respiration and fermentation

No. of lectures : 5

- 4.1 Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate /nitrite and nitrate/ammonia respiration; fermentative nitrate reduction)
- 4.2 Fermentation - Alcohol fermentation and Pasteur effect; Lactate fermentation (homofermentative and heterofermentative pathways), concept of linear and branched fermentation pathways

(Chapter 5, Microbial metabolism by Gottschalk G, 2nd Ed., Springer, 2011 (Reprint), Pages :122-125, Pages :210-219 and Pages: 232-233)

Unit 5 Chemolithotrophic and Phototrophic Metabolism

No. of lectures : 8

- 5.1 Introduction to aerobic and anaerobic chemolithotrophy with an example each. Hydrogen oxidation (definition and reaction) and methanogenesis (definition and reaction)
- 5.2 Introduction to phototrophic metabolism - groups of phototrophic microorganisms, anoxygenic vs. oxygenic photosynthesis with reference to photosynthesis in green bacteria and cyanobacteria

(Chapter 5, Microbial metabolism by Gottschalk G, 2nd Ed., Springer, 1986, Pages: 283-285, 307-311)

Unit 6 Nitrogen Metabolism - an overview

No. of lectures : 5

- 6.1 Introduction to biological nitrogen fixation
- 6.2 Ammonia assimilation
- 6.3 Assimilatory nitrate reduction

(Chapter 10, Prescott, Harley and Klein's Microbiology by Willey JM, Sherwood LM and Woolverton CJ, 7th Ed., McGraw Hill Higher Education, 2008, Pages: 235-238)

PRACTICALS

MARKS: 50

1. To study and plot the growth curve of *E. coli*
2. Calculations of generation time and specific growth rate of bacteria from the graph plotted with the given data
3. Effect of temperature on growth of *E. coli*
4. Effect of pH on growth of *E. coli*
5. Demonstration of alcoholic fermentation

SUGGESTED READINGS

1. Madigan MT, and Martinko JM (2006). Brock Biology of Microorganisms. 10th edition. Prentice Hall International Inc.
2. Moat AG and Foster JW. (2002). Microbial Physiology. 4th edition. John Wiley & Sons
3. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India

ONLINE READING MATERIAL

1. <http://nsdl.niscair.res.in/handle/123456789/391/browse-title>.