Biochemistry

1. Structure and function of proteins
2. General characteristics of enzyme function, regulation of enzymes
3. Kinetic parameters of enzyme function; the Michaelis-Menten model
4. Enzyme inhibition, types of inhibition
5. The structure and function of biological membranes
6. Basics of glycobiology
7. Carbohydrate catabolism I: Glycolysis and its regulation
8. Carbohydrate catabolism II: Citric acid cycle and its regulation
9. Carbohydrate catabolism III: Terminal oxidation and oxidative phosphorylation
10. Carbohydrate catabolism IV: Pentose phosphate pathway and its regulation
11. Gluconeogenesis, glycogen metabolism
12. The catabolism and anabolism of fatty acids
13. Amino acid catabolism and urea cycle
14. Structure and function of DNA and RNA
15. Storage, flow, expression of genetic information; regulation of gene expression
16. Characteristics of restriction enzymes and their use in molecular biology
17. Describe the basic characteristics of vectors and their application in molecular biology
18. Theoretical basis and application of PCR
19. Significance of genome sequences in biological research
20. Examining the function of genes, describe the microarray method

General Microbiology + Mycology + Microbiological Physiology

1. Basics of organizing the microworld
2. General characterization of microorganisms
3. Introduction of animal and plant viruses, bacteriophages
4. General and comparative introduction of microorganisms belonging to the *Archaea* domain
5. Introduction of *Bacteria* domain I.: *Chloroflexi*, *Chlorobi*, *Cyanobacteria*, *Chlamydiae* strains
6. Introduction of *Bacteria* domain II.: *Spirochaetes*, *Proteobacteria*, *Firmicutes*, *Actinobacteria* strains
7. Introduction of the structural types of fungi
8. Sexual, asexual and parasexual reproduction of fungi
9. Symbiosis of fungi and plants, fungal pathogenesis of insect and human hosts
10. Introduction of the role of microorganisms in the formation and maintenance of terrestrial life
11. The carbon cycle in nature. Carbon dioxide and methane utilization
12. Energy production mechanisms in the microworld
13. Substrate transport mechanisms of prokaryotic and eukaryotic cells: uptake, release
14. Nitrogen assimilation, nitrogen metabolism, denitrification
15. The physiological significance of sterols and lipids

Bioprocess Engineering

1. Basics of microbial stoichiometry, metabolization of substrates, substrate and energy balance
2. Isolation and preservation of microorganisms in the bioindustry.
3. Strain improvement in the bio-industry.
4. Industrial fermentation media: design and important components.
5. Inocula development, scale-up.
6. Principles of bioreactor design.
7. Batch, fed-batch, continuous and solid-state fermentation systems
8. Mass transfer operations. Oxygen transfer, the basic context of aeration. Foaming, antifoaming, rheological properties of the medium
9. Ensuring of fermentation technological parameters: instrumental measurement, sensors, online and offline control, automation
10. Basic operations of product recovery and purification (downstream processing) I.: filtration, centrifugation, sedimentation, electro-precipitation, crystallization.
11. Basic operations of product recovery and purification (downstream processing) II.: adsorption, extraction, ultrafiltration, chromatography, lyophilization
12. Basic processes of enzymatic and microbial bioconversion: oxidation, reduction, hydrolysis, transglycosylation, resolution, isomerization, condensation
13. Aerobic and anaerobic detoxification, nitrification, denitrification, phosphorus and metal removal
14. Biofuel production technology I.: production of bioalcohol and biodiesel
15. Biofuel production technology II: biogas production.
16. Technology of the production of organic acids
17. Technology of the production of amino acids
18. Technology of the production of antibiotics: beta-lactams, aminoglycoside
19. Technology of the production of antibiotics: tetracyclines, macrolides
20. Technology of the production of vitamins and enzymes