B.Sc. Microbiology (Colleges-revised) 2008-09
Annexure No. 33 A
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B. Sc. Microbiology (Colleges-revised) 2008 - 09

ANNEXURE NO. 33 A

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Bharathiar University, Coimbatore.

B. Sc., Microbiology Degree Course with Compulsory Diploma in Diagnostic Microbiology

Scheme of Examination - CBCS Pattern (Affiliated Colleges)

For the students admitted during the academic year 2008 – 2009 batch onwards

<table>
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<th>Part</th>
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* - Students has to submit a record of work done during their training period which will be evaluated through viva voce along with the core practical III examination.

Students should undergo an institutional training for a continuous period of 15 days before semester VI
@ No University Examinations. Only Continuous Internal Assessment (CIA)
# No Continuous Internal Assessment (CIA). Only University Examinations.

**List of Elective papers (Colleges can choose any one of the paper as electives)**

| Elective – I | A Recombinant Dna Technology - II |
|             | B Dairy Microbiology |
|             | C Biomolecules |
| Elective – II | A Medical Microbiology - I |
|             | B Medical Biochemistry |
|             | C Plant Biotechnology |
| Elective - III | A Medical Microbiology – II |
|             | B Entrepreneurial Microbiology |
|             | C Bionanotechnology |
SEMESTER - I
CORE PAPER I : FUNDAMENTALS OF MICROBIOLOGY

UNIT – I

UNIT – II
Microscopy and Staining - Microscopy – Principles and application – Bright field, Dark field, Phase contrast, Fluorescence, SEM & TEMS - Specimen preparation of electron microscopy – freeze etching - Staining - Stains and Staining reactions – Types of staining – Simple, Differential (Gram’s, Spore, AFB_), Capsule staining, Nuclear and Flagella staining - Albert.

UNIT – III

UNIT – IV
Culture techniques - Media preparation - Solid and Liquid- Types of Media – Crude, Semi Synthetic, Synthetic, Enriched, Enrichment, Selective, Differential and Special Purpose Media (one eg for each type). Anaerobic culture technique – Wright’s tube, Roll tube, Mcintosh fildes jar method - Pure culture technique – Tube dilution, Pour, Spread, Streak and Micromanipulator.

UNIT – V

References

**SEMESTER -II**

**CORE PAPER II : MICROBIAL DIVERSITY**

**UNIT – I**

**UNIT – II**

**UNIT – III**
Taxonomy of Photosynthetic Eubacteria and Archaebacteria- General characteristics.

**UNIT – IV**
Taxonomy of Fungi (Alexopolous) -General Characteristics-Life Cycles of Mucor, Neurospora, Agaricus, Dictyostelium.

**UNIT – V**

**References**

**SEMESTER -II**

**CORE PAPER III :CELL BIOLOGY**

**UNIT – I**

**UNIT – II**
UNIT III
Cell division in Bacteria – Binary fission - Cell division of Eukaryotes – Mitosis and Meiosis.

UNIT IV

UNIT V
Archaebacterial cell wall and cell membranes of Methanogens - Halophiles - Thermoacidophiles.

References

SEMESTER II
GR A CORE PRACTICAL 1

1. Laboratory precautions
2. Preparation of cleaning solutions
3. Antiseptics and disinfectants
4. Principles of aseptic techniques
5. Culture media preparation – Liquid and Solid medium
6. Selective and differential media
7. Methods of sterilization and testing of sterility
8. Enumeration of Bacteria, Fungi and Actinomycetes from soil
9. Pure culture techniques – pour plate, spread plate and looping method
10. Phenol co-efficient test
11. Cultural characteristics of microorganisms-colony morphology on nutrient agar slants, nutrients broth
12. Maintenance and preservation of cultures
13. Staining of bacteria-Simple, Negative, Gram, Spore and AFB, Fungal wet mount-LCB-Slide culture method
14. Isolation of halophiles and thermophiles
15. Cultivation of anaerobic micro organisms – Wrights tube – McIntosh fildes jar
16. Micrometry
References


SEMESTER –III

CORE PAPER IV : MICROBIAL PHYSIOLOGY

UNIT – I
Nutrition: Nutritional requirements of microorganisms – Autotrophs, Heterotrophs, Photoautotrophs, Chemoautotrophs, Copiotrophs, Oligotrophs, Endospore formation in Bacteria.

UNIT – II

UNIT -III

UNIT- IV
Anaerobic respiration – sulphur, nitrogenous compounds and Co2 as final electron acceptor. Fermentation – alcoholic, propionic and mixed acid fermentation.

UNIT- V
Photosynthesis – Oxygenic and Anoxygenic, Carbon dioxide fixation, Biosynthesis of bacterial cellwall, biosynthesis of aminoacids ( glutamic acid family )- Bioluminescence.
References

SEMESTER –IV
CORE PAPER V: BIOINSTRUMENTATION
PRINCIPLES AND APPLICATIONS

UNIT – I
Autoclave, Hot air oven, Incubator, Water Bath, Laminar air flow, BOD incubator, Centrifuges – Bench top, High sped , Ultra centrifuge.

UNIT – II
pH meter, Conductivity meter, Lyophilizer, McIntosh anaerobic jar, Biosensor, Metabolic shaker.

UNIT -III

UNIT –IV
Colorimetry, Turbidometry, Spectrometry – UV & Visible spectrophotometer, Flame photometry- Micronutrient analysis.

UNIT-V
Biochemical calculations-preparations of Molar solutions - Buffers- Phosphate, Acetate, TE, TAE- calculation of Normality ,PPM- Ammonium sulphate precipitation.

References
2. Dean, Willard and Merrit, Instrumental Methods of analysis Asian Ed.
SEMESTER IV
GR A CORE PRACTICAL II

1. pH measurements
2. Spectrophotometry
3. Protein estimation (Lowry et al / Bradford)
4. Paper chromatography
5. Thin layer chromatography
6. Electrophoresis - Proteins
8. Extraction of pigments
10. Preparation of Buffers – Acidic and Alkaline range
11. Preparation of Molar solutions
12. Preparation of 0.1 and 1 Normal solutions

SEMESTER -V
CORE PAPER VI - MICROBIAL GENETICS

UNIT-I
DNA-the genetic material, RNA-the genetic material, characters of a genetic material, chemistry & molecular structure of DNA, special structure of DNA, structure and types of RNA.

UNIT-II
Bacterial chromosome, organization of genes in prokaryotes, DNA – replication in prokaryotes – Meselson and Stahl experiment- mechanism & enzymology of replication – theta replication & rolling circle replication.

UNIT-III

UNIT-IV
Mutation-spontaneous and induced-mutagen & mutagenesis – DNA repair mechanism.

UNIT-V
Genetic exchange – transduction(specialized & generalized), transformation, conjugation & Hfr mapping, genetic recombination.
References

2. Freifelder, S, 1987 Microbial Genetics, Jones & Bartlett, Boston.

SEMESTER -V
CORE PAPER VII - PRINCIPLES OF IMMUNOLOGY

UNIT - I
History and Scope of Immunology-The basis of defence mechanisms-Cell and Organs involved in immune system-Phagocytosis.

UNIT - II
Types of immunity-antigen-antibody-types-complement pathways-classical and alternate-Immunoglobins-structure and functions.

UNIT - III
Allergy and hypersensitivity-classification types and mechanisms-autoimmunity-mechanisms and autoimmune response diseases.

UNIT - IV
Quantitative study of antigen-antibody reactions –agglutination, precipitation ELISA-radioimmune assay(RIA)-monoclonal antibodies and its applications(Hybridoma technology)

UNIT – V
Immunohematology-blood transfusion-ABO grouping-Rh factor-Tissue transplantation-HLA typing-mechanism of acceptance and rejection.

References

SEMESTER – V

CORE PAPER VIII - FOOD MICROBIOLOGY

UNIT – I
Food and microorganisms – Important microorganisms in food (Bacteria, mold and yeasts); factors affecting the growth of microorganisms in food – pH, moisture, oxidation – reduction potential, nutrient content and inhibitory substances and biological structure.

UNIT – II

UNIT - III
Spoilage of food - cereals, vegetables, fruits, egg and milk – canned foods.

UNIT - IV
Fermented food – pickled cucumber, saurkraut, soy sauce, Bread, Idli – Fermented dairy products – Yoghurt and cheese.

UNIT - V
Food borne diseases – food poisoning and food borne infections – bacterial and mycotoxins- Investigation of food poisoning outbreaks- food standards, quality control.

References

SEMESTER – V
CORE PAPER IX
RECOMBINANT DNA TECHNOLOGY- I

UNIT- I
Gene manipulation – Definition and Application, Restriction Enzymes, Discovery, Types and Mode of Action, Ligases and Methylases.

UNIT - II
Isolation - Purification of DNA (Chromosomal and Plasmid), Isolation and Purification of RNA, Chemical Synthesis of DNA, Genomic Library and cDNA Library.
UNIT -III
Vectors – Plasmid based Vectors- Natural (PSC101, PSF2124, PMB1), Artificial – pBR322 & pUC Construction: Phage based Vectors- λ (Lamda) phage Vectors and its Derivatives: Hybrid Vectors- Phagemid, Phasmid and Cosmid, BAC and YAC.

UNIT -IV
Gene Transfer Techniques: Physical – Biolistic Method , Chemical- Calcium chloride and DEAE Methods , Biological invtrot package method - Screening and Selection of recombinants- Direct Method – Selection by Complementation, Marker inactivation Methods , -Indirect Methods- Immunological and Genetic Methods

UNIT- V
PCR , Blotting (Southern, Western, Northen) Techniques, RFLP and Application , -RAPD and Application,-Microarray.

References

SEASON -VI
CORE PAPER X - FERMENTATION TECHNOLOGY

UNIT -I
Industrially important strains- Screening methods- Strain development for Improved yield- Mutation, Recombination and protoplastic fusion.

UNIT -II
Fermentation- submerged and solid state- component parts of a CSTR- types of Fermentors (Tower, cylindroconical & airlift) – batch fermentation – continuous Fermentation.

UNIT -III
UNIT - IV
Single cell protein- Bakers yeast, spirulina- Details of mushroom development- Oyster (Pleurotus) and Button (Agaricus) mushroom.

UNIT - V
Downstream process- Intercellular and extracellular- Centrifugation, filtration, Floatation- solvent extraction, precipitation- Breakage of cells- physical and Chemical methods.

References

SEMESTER - VI
CORE PAPER XI
ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

UNIT - I
Distribution of microorganisms in nature – Microbial communities in soil- factors Influencing the microbial density in soil- zymogenous and autochthonous flora in Soil- Microbial associations – symbiotic proto cooperation, ammensalism, Commensalism, syntropism, parasitism and predation with suitable examples.

UNIT - II
Microbial decomposition; cellulose,Hemi cellulose, lignin, pectin and chitin. –Factors influencing degradation- acetate utilization -bioconversion of organicwastes- sugarcane wastes- coir pith composition- composting. principles andApplications- conversion process

UNIT- III

UNIT- IV
Water microbiology, algae, phytoplankton- eutrophication- water treatment- Primary, secondary and tertiary. Drinking water- Portability- MPN technique.

UNIT-V
Aero microbiology- aerosol, droplet nuclei, air pollution- sources (Microbiological) – air quality analysis- air sampling devices.
References

SEMESTER - VI
CORE PAPER XII - VIROLOGY

UNIT - I

UNIT- II

UNIT-III

UNIT - IV
Viruses of Eukaryotes- Reproduction of animal and plant viruses- Viruses of Algae, fungi and viruses- viruses and cancer.

UNIT- V
Human viral infections- pathogenicity and diagnosis of Hepatitis (A.B). Mumps, AIDS, Rabies, Influenza, Measles, Rubella, Herpes simplex I&II.
SEMESTER VI
CORE PRACTICAL III

1. Isolation of Nucleic acids
2. Isolation of drug resistant mutants using UV and Chemical agents
3. Induction of Lac Operon – ONPG method
4. Isolation of E. coli plasmid DNA by agarose gel electrophoresis
5. Isolation and identification of major bacterial pathogens – E. coli, Klebsiella pneumoniae, Proteus, Salmonella, Shigella, Pseudomonas, Staphylococcus aureus and Streptococcus pyogenes.
6. Identification of clinically important fungi – Candida albicans, Cryptococcus neoformans and Aspergillus
7. Methylene blue reduction test
8. Microbial analysis of spoiled food – Bread and Vegetables
9. Identification of fungal food spoilers – Aspergillus, Mucor, Penicillium, Rhizopus
10. Direct microscopic examination of curd – observation of lactobacilli
11. Enzyme production and assay – protease and amylase
12. Alcohol production / wine
13. Immobilization– Demonstration
15. Observation of parasites – Entamoeba, Plasmodium, Ascaris, Taenia.
16. Isolation and titration of coliphages
17. Cultivation of animal viruses in embryonated eggs.
SEMESTER III
DIPLOMA IN DIAGNOSTIC MICROBIOLOGY

DIPLOMA PAPER 1

ORGANIZATION OF CLINICAL MICROBIOLOGY LABORATORY

UNIT –I

UNIT – II
Laboratory safety. General safety considerations – biohazards and practices specific to microbiology – classification of biological agents on the basis of hazards.

UNIT – III
Special precautions for specific areas of clinical Microbiology – Bacteriology, Mycobacteriology, Mycology, Parasitology, Virology and Serology.

UNIT – IV

UNIT – V
Management of clinical Microbiology laboratory – general approaches– rapid detection – speeding up of identification results and susceptibility results – computerization.

References

1. Diagnostic Microbiology, Bailey & Scott, s, 1990 8th edn. The Mosby Company.

2. Medical laboratory manual for tropical countries, Microbiology by Monica chees brough (ELBS) Tropical health technology butter worth’s, 1985.


SEMESTER IV
DIPLOMA PAPER II
DIAGNOSTIC MICROBIOLOGY – I
(BACTERIOLOGY AND SEROLOGY)

UNIT – I

UNIT – II
Cultivation and isolation of viable pathogens – Media used – differential, selective, enrichment and enriched media.

UNIT – II
Cultivation and isolation of viable pathogens – Media used – differential, selective, enrichment and enriched media.

UNIT – III
Biochemical tests – identification of organisms - Susceptibility testing, reporting of results and interpretation.

UNIT – IV
Serology – Antigen - antibody reactions – Agglutinations (blood grouping, WIDAL), Precipitation (VDRL), Immunodiffusion – mono and double immunodiffusion, Immunoelectorophoresis (rocket, counter current).

UNIT – V
Advanced techniques – automated methods – ELISA, RIA. Applications of Nucleic acid hybridization, PCR and blotting in diagnosis.

References

SEMESTER V

DIPLOMA PAPER III
DIAGNOSTIC MICROBIOLOGY –II
(VIROLOGY, MYCOLOGY AND PARASITOLOGY)

UNIT –I
Laboratory methods in basic Mycology –Collection and transport of clinical specimens –Direct Microscopic examination, culture media and incubation, Serological tests for fungi – Antifungal susceptibility testing

UNIT –II
Laboratory methods for parasitic infections – Diagnostic techniques for faecal, gastrointestinal and urino-genital specimen.

UNIT –III

UNIT –IV
Laboratory methods in basic virology- detection of viral antigen (fluorescent antibody and solid phase immunoassays). Viral Serology- Special consideration- Hepatitis and AIDS.

UNIT –V
Viral culture- Media and cells used –Specimen processing – isolation and identification of viruses.

References
SEMESTER VI
DIPLOMA PAPER IV

DIPLOMA PRACTICAL –I

2. Processing of specimen
   2.1- Gram’s Staining
   2.2- Motility
   2.3- Culturing techniques-McConkey agar, Blood agar, Chocolate agar, Mannitol salt agar and XLD agar
4. Susceptibility testing- Kirby Bauer method.

DIPLOMA PRACTICAL –II

1. Slide agglutination - Blood grouping
2. Tube agglutination- WIDAL
3. Precipitation – RPR
4. Immunodiffusion- Radial, Ouchterlony’s
5. Immunoelectrophoresis- Rocket and Counter current
6. ELISA
7. SDS-PAGE
8. Western blot
9. Observation of fungi- LCB or KOH mount
10. Observation of parasites- Entamoeba, Plasmodium, Ascaris, Taenia
ELECTIVE I – A

RECOMBINANT DNA TECHNOLOGY- II

UNIT –I
Microbial synthesis of commercial products-Proteins-Pharmaceuticals – Interferons - Human growth hormone- Antibiotics -Biopolymers.

UNIT –II
Vaccines – subunit vaccines –Monoclonal antibody. Gene therapy, Regulating the use of Biotechnology

UNIT –III
Transgenic plants-Ti plasmid – insect, virus, herbicide resistant plants – microbial insecticides – bacteria, fungi and viruses.

UNIT IV

UNIT -V
DNA finger printing and its Application. Human Genome Project and History and its Application , Bioremediation.

References

ELECTIVE I – B : DAIRY MICROBIOLOGY

Unit I
Milk-Introduction, composition,. Microorganisms in Milk – Bacteria, Yeasts, Moulds. Starter Cultures – Starter cultures their biochemical activities. (Streptococcus thermophilus, Lactobacillus bulgaricus) starter culture preparation, mesophilic and thermophilic organisms. Dairy processing unit operations: Clarification, separation, standardization, toning of milk, Pasteurization, UHT treatment, homogenization, Membrane processing, storage, transportation and distribution of milk. Judging and grading of milk and its products.

Unit II
Milk and milk products – Definitions, composition, food and nutritive value of milk, properties of milk and its constituents. Dairy Products Production : Overview
and Fluid Milk Products, Concentrated and Dried Milk Products, condensed milk, evaporated milk, whole and skimmed milk powder, cultured Dairy Products: Cheese, yogurt, fermented beverages, Whipped Cream, Ice Cream, Butter, Whey Products, fermented milks,

**Unit-III**

Microbiology of fermented milk products - Acid fermented milks (acidophilus milk, yoghurt). Slightly acid fermented milks (Cultured butter milk), Acid-alcoholic fermented milk (Kefir). Fermented milk production with extended self life (labneh). Milk borne diseases, antimicrobial systems in milk, sources for contamination of milk - bacterial with examples of infective and toxic types –, Clostridium, Salmonella, Shigella, Staphylococcus, Campylobacter, Listeria. Mycotoxins in food with reference to Aspergillus species.

**Unit – IV**


**Unit V**

Quality assurance: Microbiological quality standards of food. Government regulatory practices and policies. FDA, EPA, HACCP, ISI. HACCP – Food safety, safety of dairy products, control of hazards

**References**

3. Applied dairy microbiology edited by Elmer Marth and James Steele.

**ELECTIVE I – C : BIO-MOLECULES**

**UNIT - I**

Carbohydrates: Definition, classification, stereochemistry, cyclic structures and anomeric forms, Haworth projections. Monosaccharides-Reactions-Characteristics of aldehyde and ketone groups. Action of acids and alkalies on sugars. Reactions of sugars due to

UNIT - II

UNIT- III

UNIT- IV
Nucleic acids; Structure of Purines and Pyrimidines; Nucleotides and Nucleosides. DNA: double helix: A, B and Z forms; DNA denaturation and renaturation. RNA: types, unusual bases. DNA as genetic material Structure of chromatids, nucleosome and histones.

UNIT- V

REFERENCES
ELECTIVE II - A
MEDICAL MICROBIOLOGY - I

UNIT- I
Infections - sources of infections - types of infections - methods of infections - definitions - epidemic, pandemic, endemic diseases - Epidemiology of infectious diseases, infectious diseases cycle - investigation of epidemics - control of epidemics.

UNIT- II
Morphology, pathogenicity and laboratory diagnosis - Gram positive organisms
Staphylococcus aureus, Streptococcus pyogenes, Bacillus anthracis, Corynebacterium diphtheriae.

UNIT- III
Morphology, pathogenicity and laboratory diagnosis - Gram positive Organisms - Clostridium perfringens, Clostridium tetani.

UNIT- IV
Morphology, pathogenicity and laboratory diagnosis - Gram negative organisms
Escherichia coli, Klebsiella, Proteus, Salmonella, Shigella, Pseudomonas, Vibrio cholerae.

UNIT - V
Morphology, pathogenicity and laboratory diagnosis - Mycobacterium Tuberculosis, Mycobacterium leprae, Treponema pallidum, Leptospira, Chlamydias, Rickettsiae.

References
5. Jawetz E Melnic JL and Adelberg EA 1998, review of Medical Microbiology Lange Medical Publications, USA
ELECTIVE II – B : MEDICAL BIOCHEMISTRY

Unit I
Disorders of carbohydrate metabolism – Diabetes mellitus, Glucose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, glycogen storage diseases, pentosuria, galactosemia

Unit II
Disorders of lipids- Plasma lipo proteins, cholesterol, triglycerides and phospholipids in health and disease, hyperlipidemia, hyperlipoproteinemia, Gaucher’s disease, Tay-Sach’s, ketone bodies, β-lipoproteinemia

Unit III
Disorders of liver and kidney- Jaundice, fatty liver, normal and abnormal functions of liver and kidney, inulin and urea clearance

Unit IV
Abnormalities in nitrogen metabolism- Uremia, hyperurecemia, porphyria and factors affecting nitrogen balance

Unit V

References

ELECTIVE II – C : PLANT BIOTECHNOLOGY

UNIT – I
Plant Tissue culture – History, Plant tissue culture media, types, constituents and preparation of media, selection of suitable medium.

UNIT – II
Protoplast culture and somatic hybridization, production of Haploid plants, Somaclonal variations, Clonal propagation (micro propagation) germplasm conservation and cryopreservation.

UNIT – III
Genetic Engineering of plants – Gene transfer methods – vector mediated gene transfer, virus – mediated gene transfer, Direct or Vectorless DNA transfer.

UNIT – IV

UNIT – V
Molecular Marker Aided plant Breeding – Molecular markers, Molecular marker assisted selection, Arid & semi-arid plant Biotech, Green house & Green home technology.

References:
Dr. U. Sathyanarayana – Biotechnology. Books and Allied Publications
ELECTIVE III - A

MEDICAL MICROBIOLOGY - II

UNIT -I

UNIT -II
Parasitic diseases- Plasmodium vivax, Giardia, Taenia solium, Ancylostoma, Ascaris, Wuchereria bancrofti, Enterobius, Trichuris trichura.

UNIT -III
Etiology and laboratory diagnosis of urinary tract infection- fever of unknown Origin meningitis, diarrhea, respiratory tract infections.

UNIT -IV
Pyogenic infections- Staphylococcus and Pseudomonas: sexually transmitted diseases, nosocomial infections-definition, sources and detection; phage typing, bacteriocin typing.

UNIT -V

References
ELECTIVE III – B : ENTREPRENEURIAL MICROBIOLOGY

UNIT I:
Entrepreneur development, activity, Institutes involved, Government contributions to entrepreneurs, risk assessment. Industrial Microbiology, Definition, scope and historical development.

UNIT II:
Microbial cells as fermentation products- Bakers yeast, food and feed yeasts, Bacterial Insecticides, Legume Inoculants, Mushrooms, Algae. Enzymes as fermentation products- Bacterial and Fungal Amylases, Proteolytic Enzymes, Pectinases, Invertases, and other enzymes.

UNIT III:
Mushroom cultivation and Composting- Cultivation of Agaricus campestris, Agaricus bisporus, and Volvariella volvacea; Preparation of compost, filling tray beds, spawning, maintaining optimal temperature, casing, watering, harvesting, storage. Biofertilizers- Historical background, Chemical fertilizers versus biofertilizers, organic farming. Rhizobium sp, Azospirillum sp, Azotobacter sp, as Biofertilizers.

UNIT IV:

UNIT V:
Brewing- Media components, preparation of medium, Microorganisms involved, maturation, carbonation, packaging, keeping quality, contamination, by products. Production of Industrial alcohol.

References:
Industrial Microbiology- L.E.Casida, jr, New age International publication.
Entrepreneurial Development in India- By Arora
Experiments in Microbiology, Plant pathology. Tissue culture and Mushroom production technology- K.R.Aneja, New age International publication.
ELECTIVE III – C : BIONANOTECHNOLOGY

Unit I:

Unit II:

Unit III:

Unit IV:

Unit V:
Applications of Bionanotechnology- Nanomedicines; Immunotoxins, Liposomes as drug carriers, Gene therapy, Personalised Medicines; Lab on chip concept. DNA Computers, Artificial Life, Hybrid materials, Biosensors.

References:
Goodsell - Bionanotechnology
Vladimir P Torchilin, Nanoparticles as Drug Carriers. Imperial College Press, North Eastern University, USA. 2006