PERIYAR UNIVERSITY
PERIYAR PALKALAI NAGAR
SALEM – 636 011

DEGREE OF BACHELOR OF
SCIENCE
CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR - B.Sc. MICROBIOLOGY

FOR THE STUDENTS ADMITTED FROM THE
ACADEMIC YEAR 2012 – 2013 ONWARDS
REGULATIONS

CONDITION FOR ADMISSION

A candidate who has passed higher secondary examination in any one of the biological sciences (Academic/Vocational stream) under higher secondary board of examination, Tamil Nadu or as per norms set by the Government of Tamil Nadu or an examination accepted as Equivalent thereto by the Syndicate subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the BSc., Microbiology degree examination of this University after a course of study of three academic years.

Duration of the course
The course for the degree of Bachelor of Microbiology shall consist of three academic years divided into six semesters.

Course of study
The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.

Examinations
The theory examination shall be three hours duration to each paper at the end of each semester. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examinations. The practical examinations for UG course should be conducted at the end of the even semester.

Maximum Duration for the completion of the UG Programme
The maximum duration for completion of the UG Programme shall not exceed twelve semesters.

Commencement of this Regulation
These regulations shall take effect from the academic year 2012-13, i.e., for students who are to be admitted to the first year of the course during the academic year 2012-13 and thereafter.

Transitory Provision
Candidates who were admitted to the UG course of study before 2012-13 shall be permitted to appear for the examinations under those regulations for a period of three years i.e., up to and inclusive of the examination of April/May 2015. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.
<table>
<thead>
<tr>
<th>Part</th>
<th>Sem</th>
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<th>Title of the paper</th>
<th>Credits</th>
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| Part -I         | II  | 12UFTA02/12UFMA02/12UFHI02 | Tamil-II/ Malayalam-II/ Hindi-II         | 3       | 25             | 75             |
| Part-II         | II  | 12UFEN02                 | English-II                               | 3       | 25             | 75             |
| Part –III- Core-II | II  | 12UMB02                  | Microbial Physiology                     | 5       | 25             | 75             |
| Part-III- Allied- II | II  | 12UBCA02                  | Biochemistry-II                          | 3       | 25             | 75             |
| Part-IV- SBEC-I | II  | 12UMBS01                  | Microbial Diversity                      | 2       | 25             | 75             |
| Part-III- Core practical | II  | 12UMBP01                  | Major Practical-I                        | 3       | 40             | 60             |
| Part-III- Allied practical | II  | 12UBCAP01                  | Allied Practical-I-Biochemistry          | 3       | 40             | 60             |
| Part-IV         | II  | 12UES01                  | Environmental Studies                    | 2       | 25             | 75             |

<p>| Part-I          | III | 12UFTA03/12UFMA03/12UFHI03 | Tamil-III / Malayalam-III/ Hindi-III     | 3       | 25             | 75             |
| Part-II         | III | 12UFEN03                 | English-III                              | 3       | 25             | 75             |
| Part-III-Core-III | III  | 12UMB03                  | Microbial Genetics                       | 5       | 25             | 75             |
| Part-III-Allied-III | III  | 12USTA06                  | Biostatistics                            | 3       | 25             | 75             |
| Part-IV-SBEC-II | III  | 12UMBS02                  | Principles of Bioinstrumentation         | 2       | 25             | 75             |
| Part-IV – NMEC-I | III  | 12UMBN01                  | Bioinstrumentation-I                     | 2       | 25             | 75             |</p>
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### B.Sc., Microbiology

(CBCS Pattern)

**THEORY QUESTION PAPER PATTERN**

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<th>Time 3 hours.</th>
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**Part – A (10 x 2 = 20)**

Answer all questions.

(Two questions from each UNIT )

**Part – B (5 x 5 = 25)**

(One question from each UNIT with internal choice)

**Part - C (3 x 10 = 30)**

Answer Any Three out of five.

(One question from each UNIT )

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### B.Sc., Microbiology

(CBCS Pattern)

**CORE PRACTICAL QUESTION PAPER PATTERN**

<table>
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**Maximum marks (University Exam) - 60**

Experiment 1 - 20 marks

Experiment 2 - 20 marks

Spotters (5 x 2 marks) - 10 marks

Record - 10 marks
LIST OF COURSES

CORE COURSES
1. Fundamentals of Microbiology
2. Microbial physiology
3. Microbial genetics
4. Immunology
5. Medical Bacteriology
6. Food and Dairy Microbiology
7. Soil and Agricultural Microbiology
8. Environmental and Pharmaceutical Microbiology
9. Virology
10. Core Practical I
11. Core Practical II
12. Core Practical III
13. Core Practical IV

ALLIED COURSES
1. Biochemistry I
2. Biochemistry II
3. Biostatistics
4. Computer Applications in Biology
5. Allied Practical I Biochemistry
6. Allied Practical II Computer Applications in Biology

ELECTIVE COURSES
1. Medical Parasitology
2. Medical Mycology
3. Bioprocess Technology

SKILL BASED ELECTIVE COURSES (SBEC)
1. Microbial Diversity
2. Principles of Bioinstrumentation
3. Recombinant DNA Technology
4. Extremophiles
5. Microbial Technology
6. Clinical Microbiology

NON MAJOR ELECTIVE COURSES (NMEC)
1. Bioinstrumentation I
2. Bioinstrumentation II

PART IV
1. Environmental Studies
2. Value Education – Yoga

PART V
1. Extension Activities (Awareness programs, participating in Grama Shaba, Watering the Plants, Campus Cleaning and any social activity)
CORE 1- FUNDAMENTALS OF MICROBIOLOGY

UNIT 1 - Definition and scope of microbiology- history and recent developments- spontaneous generation-biogenesis contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Elie Metchnikoff and Fleming.

UNIT 2 - Microscopy- simple and compound microscopy- dark field-phase contrast-fluorescence and electron microscopy.

UNIT 3 - Stain and staining techniques-simple, differential and special staining (endospore, capsular and granular).


UNIT 5 - Antimicrobial chemotherapy - antibiotics - mode of actions - antimicrobial resistance-tests for sensitivity to antimicrobial agents.

REFERENCES


CORE 2- MICROBIAL PHYSIOLOGY

UNIT 1 - Cellular structures of prokaryotes and eukaryotes- cell wall, flagella, slime layer, capsule, pili, cytoplasmic membrane and cytoplasmic inclusions – sporulation and its mechanism- structure and functions of Cyanobacteria.


UNIT 3 - Metabolism-ATP synthesis and utilization – (photophosphorylation, oxidative phosphorylation, substrate level phosphorylation).

UNIT 4 - Metabolic pathways – glycolysis, pentos phosphate pathways, EMP, TCA and Glyoxalate cycle.

UNIT 5 - Photosynthesis – characteristics and metabolism of autotrophs- photosynthetic bacteria and cyanobacteria - autotrophic CO₂ fixation and mechanism of photosynthesis.

REFERENCES

CORE 3 – MICROBIAL GENETICS

UNIT 1 - Introduction and history of microbial genetics. DNA as a genetic material. Physical structure and chemical composition of DNA -RNA and its types, RNA as a genetic material.

UNIT 2 - DNA replication- types and experimental proof of replication-enzymes involved in DNA replication.


UNIT 4 - Gene transfer mechanisms- transformation, conjugation and transduction. Plasmid- characteristics and types.

UNIT 5 - Mutation- types of mutation- molecular basis of mutation- mutagenesis, detection of mutants- Ames test , DNA repair mechanisms .

REFERENCES

CORE 4 - IMMUNOLOGY

UNIT 1 - History of immunology- host-parasite relationship - immune system y-innate and acquired immune system y- Humoral and cell mediated immune system y.

UNIT 2 - Structures and functions of cells and organs involved in immune system, Primary and Secondary lymphoid organs.

UNIT 3 - Antigens- types, properties-Immunoglobulin’s- structure, types and properties-complement- classical and alternative pathways.

UNIT 4- Antigen – antibody interactions – reactions – Agglutination – Precipitation - Complement fixation – Immunofluorescence – ELISA - RIA.

UNIT 5 - Hypersensitivity reactions- antibody mediated-type 1, type 2 and type 3 - cell mediated- type 4 – Immunohaematology.

REFERENCES

CORE 5 - MEDICAL BACTERIOLOGY

UNIT 1- Collection and transport of clinical specimens for microbiological examinations- Virulence factors of bacteria causing human infections- Normal flora of human body.

UNIT 2- Morphology, culture, biochemical, pathogenicity, laboratory diagnosis and prevention of bacterial diseases - Staphylococcus aureus, Streptococcus pyogens, S.pneumoniae, Neisseria gonorrhoeae, N.meningitidis.

UNIT 3- Morphology, culture, biochemical, pathogenicity, laboratory diagnosis and prevention of bacterial diseases - Mycobacterium tuberculosis, M.leprae, Corynebacterium diphtheriae, Clostridium tetani, C.botulinum, Bacillus anthracis.

UNIT 4- Morphology, culture, biochemical, pathogenicity, laboratory diagnosis and prevention of bacterial diseases - Salmonella typhi, Shigella dysentriae, Vibrio cholerae, Escherichia coli, Pseudomonas aeruginosa, Yersinia pestis.

UNIT 5- Morphology, culture, biochemical, pathogenicity, laboratory diagnosis and prevention of bacterial diseases - Treponema pallidum, Leptospira interrogans, Mycoplasma pneumoniae, Chlamydia trachomatis.

REFERENCES

CORE 6 - FOOD AND DAIRY MICROBIOLOGY

UNIT 1 - Food as a substrate for microbes - microbes involved in food microbiology- mould, yeast, bacteria - factors affecting the growth of microorganisms in food.


UNIT 3 - Food spoilage- general principles- underlying food spoilage and contamination - cereals, vegetables, fruits and poultry products, meat, fish, sea foods.

UNIT 4 - Microorganisms in milk and milk products - yoghurt, cumis - butter and cheese - Quality control of milk – MBRT, Litmus Milk - Phophatase tests.

UNIT 5 - Food borne diseases – food poisoning – infective and toxic bacterial food borne diseases and their diagnosis – food sanitation and its control measures (HACCP).

REFERENCES

CORE 7 - SOIL AND AGRICULTURAL MICROBIOLOGY

UNIT 1 - Introduction to soil microbiology – Properties of soil (structure, texture, formation). Types and significance of soil microbes – Factors affecting microbial population - Soil fertility test.

UNIT 2 - Biogeochemical cycle – Carbon, Phosphorous, Nitrogen – Biological nitrogen fixation- Nitrogen fixers - Root nodule formation - Nitrogenase, Hydrogenase.

UNIT 3 - Microbial interaction between microbes Neutralism, Commensalism, Synergism, Mutualism, Amensalism, Symbiosis, Competition, Parasitism and Predation. Interaction of microbes with plants - Rhizosphere and Mycorrhizae - interaction of microbes, insects and rumen.

UNIT 4 - Plant pathology (symptoms, disease cycle and control measures) –Bacterial diseases - Blight of rice, Citrus canker-Fungal disease-Red rot of sugarcane, Wilt of cotton, Tikka leaf spot of ground nut.

UNIT 5 - Biofertilizers - Rhizobium and Azotobacter, Cyanobacteria, Azolla.

REFERENCES

CORE 8 - ENVIRONMENTAL AND PHARMACEUTICAL MICROBIOLOGY

UNIT 1 - Microbiology of air - Sero microbial pathways - Enumeration of bacteria from air - Air sampling devices - Air sanitation - Air borne diseases.

UNIT 2 - Microbiology of water - Potability of water - Indicator organisms - Water purification - Water borne diseases and their control measures.

UNIT 3 - Microbiology of sewage - chemical and biochemical characteristics of sewage - BOD and COD - Sewage treatment - physical, chemical and biological (trickling filter, activated sludge and oxidation pond) treatment - disposable of wastes.

UNIT 4 - Sterility testing of pharmaceutical products – Injectables – IV fluids – Pyrogen testing. Antiseptics, disinfectants and their standardisation.

UNIT 5 - Production of Vaccine – BCG and Typhoid. Production of Toxoid – Tetanus, and Diphtheria. Preparation of Antisera and their standardization.

REFERENCES

CORE 9 - VIROLOGY

UNIT 1 - General properties – Classification - Cultivation- Isolation- and identification of viruses - Sero diagnosis and molecular diagnosis of viral infections.


UNIT 4 - Nomenclature and classification of Plant Viruses – Disease symptoms, transmission and detection of Plant Viruses. Tobacco Mosaic Virus, Cauliflower Mosaic Virus and Tomato Yellow Mosaic Virus – Potato Virus.

UNIT 5 - Viruses of importance – Bacteriophages – Structures, types, uses in microbiology – Typing and application in bacterial genetics.

REFERENCES
UNIT 1 - Introduction- Classification- Laboratory diagnosis of parasitic infections-
Direct and concentration methods, blood smear examination.

UNIT 2 - *Entamoeba histolytica*, *Giardia intestinalis*, *Trichomonas vaginalis*,
*Balantidium coli*.

UNIT 3 - *Haemoflagellates* - *Leishmania donovani*, *Trypanosoma brucei*, *T.cruci*,
*Malarial parasite* - *Plasmodium* species.

UNIT 4 - *Taenia solium*, *T. saginata*, *Paragonimus westermani*, *Fasciola hepatica*,
*Fasciolopsis buski*.

UNIT 5 - *Ancylostoma duodinale*, *Ascaris lumbricoids*, *Wuchereria bancrofti*,
*Enterobius vermicularis*.

REFERENCES

   All India Publishers and Distributors, Medical Books Publishers, New Delhi.
   Brothers Medical Publishers (P) Ltd., New Delhi.
   and Allied (P) Ltd., Kolkata.
5. Monica Cheesbrough (2003). District Laboratory Practice in Tropical Countries. Part
   1 & 2 Low-Price edition, Cambridge University Press.
ELECTIVE - MEDICAL MYCOLOGY

UNIT 1 - Introduction to Medical Mycology - Morphological features of fungi - Classification of medically important fungi, isolation, identification and diagnosis of fungi from clinical specimens.

UNIT 2 - Superficial mycosis- *Pityriasis versicolor, Taenia nigra* - Cutaneous mycosis- Dermatophytosis.

UNIT 3 - Subcutaneous mycosis- Sporotrichosis, Mycetoma, Chromoblastomycosis.


UNIT 5 - Antifungal agents – Sensitivity tests - Mycotoxins.

REFERENCES

ELECTIVE – BIOPROCESS TECHNOLOGY

UNIT 1 - Industrially important microorganisms - Screening Techniques- Primary and Secondary - Preservation of cultures - Strain improvement- Development of inoculum for various fermentation processes.


UNIT 3 - Fermentor – Components, Types of fermentors, Control systems in fermentation – pH, Temperature, Oxygen and foam. Computer applications in fermentation technology.

UNIT 4 - Microbial production of Wine, Ethanol. Organic acids - Citric acid and Lactic acid, Acetic acid.

UNIT 5 - Microbial production of Amino acid – Lysine. Enzyme - Alpha amylase. Vitamin B12 – Antibiotics – Penicillin, Streptomycin

REFERENCES

SBEC - MICROBIAL DIVERSITY

UNIT 1 - Diversity of microbial world - Organizing, classifying and naming of microorganism - Whittaker’s five system of classification.

UNIT 2 - Bacterial Taxonomy - Methods in bacterial identification - Bergey’s systematic classification of bacteria.

UNIT 3 - Fungal classification - Alexopolous method.

UNIT 4 - Photosynthetic Protists - Algal classification.

UNIT 5 - Classification of viruses and Medically important protozoa.

REFERENCES

SBEC - PRINCIPLES OF BIOINSTRUMENTATION


UNIT 2 - Chromatography principle of separation, detection and uses of thin layer chromatography – Ion exchange chromatography – Gel filtration (molecular sieve chromatography – Ion exchange chromatography)

UNIT 3 - Electrophoresis and blotting, classification of electrophoretic methods – Agarose gel electrophoresis – SDS - PAGE – Southern blotting – Northern blotting - Western blotting - Dot blotting - Colony blotting.

UNIT 4 - Spectrophotometric methods - Beer - Lamberts law – Principle, operating mechanism and applications of colorimeter, Spectrophotometer and Fluroscence spectrophotometer.

UNIT 5 - Radioisotope methods types of radioactive decay - Half life and radioactivity- GM counter – Scintillation counter - Autoradiography.

REFERENCES

SBEC- RECOMBINANT DNA TECHNOLOGY

UNIT 1 - Achievements of DNA technology - cloning vectors Plasmids (pBR 322, pUC 18) - Bacteriophage vectors (λ vectors) - cosmid - Phagemid - Artificial chromosome (YAC).

UNIT 2 - Nomenclature and classification of restriction endonucleases - ligases - gene cloning in prokaryotes – Cloning strategies – construction of genomic libraries and cDNA libraries.

UNIT 3 - Methods of gene transfer in bacteria - Transformation - Microinjection - Gene gun - PCR methods and application.

REFERENCES

SBEC - EXTREMOPHILES

UNIT 1 - Survival at extreme environments - Starvation - Adaptive mechanisms in thermophilic, alkalophilic, asmophilic and barophilic, psychrophilic microorganisms – Hyperthermophilies and halophiles - Importance in biotechnology.


UNIT 3 - Microbes in toxic environments like acid mine drainage, coal desulphurisation, wastes containing cyanides, xenobiotics and radio isotopic materials.

REFERENCES

UNIT 2 - Production of Biotechnological products and their significance - Biofertilizer - VAM - Biopesticide - Bacillus thuringiensis - Biopolymer - Xanthan - SCP - Yeast - Cultivation of mushrooms.

UNIT 3 - Commercial production of microbial products - Insulin - Interferon - Growth Harmone, Immobilization - Principles, methods and significance.

REFERENCES

UNIT 1 - Clinical diagnosis of acute Respiratory Tract Infections (RTI), Diphtheria, Sore throat, Tuberculosis and Pertusis.

UNIT 2 - Clinical diagnosis of Meningitis, Tetanus, Gas gangrene, Diarrhoea and Cholera.

UNIT 3 - Clinical diagnosis of Pyrexia of Unknown Origin (PUO), Urinary Tract Infections (UTI), Sexually Transmitted Diseases (STDs) and Hospital acquired infections.

REFERENCES

UNIT 1 - Basic rules of a microbiology laboratory - Basic requirement microbiology laboratory - Basic principle, operating mechanism and applications of Autoclave, Hot Air oven, Laminar air flow and pH meter.

UNIT 2 - Centrifugation method - Basic principles of sedimentation, Centrifugal force, Swedberg constant. Types of centrifuge- Differential, density gradient and ultra centrifugation.

UNIT 3 - Chromatography- Preparation, packing of columns, adsorption and elution. Paper, Thin layer, Ion-exchange and HPLC techniques and their applications.

REFERENCES

NMEC - BIOINSTRUMENTATION -II

UNIT 1 - Spectrometric methods - Beer’s Lambert’s Law - Principles, Operating mechanisms and applications of colorimeter, Spectrophotometer and Fluorescence spectroscopy.

UNIT 2 - Electrophoresis - Basic principles and their application - Agarose gel electrophoresis - SDS - PAGE.

UNIT 3 - Blotting techniques - Southern, Western and Northern blotting - Autoradiography - Scintillation counter and Geiger Muller counter.

REFERENCES

CORE PRACTICAL – I  
(End of the first year)

1. Handling and maintenance of compound microscope
2. Measurement of Microorganisms – Micrometry
3. Cleaning of Glassware’s
4. Staining techniques - Simple, Gram’s, Acid - fast, Spore and Capsular staining methods
5. Handling of laboratory instruments
   i. Autoclave
   ii. Hot air oven
   iii. Laminar air flow
   iv. pH meter
6. Microscopic examinations of
   i. Algae - *Oscillatoria, Spirullina* spp.
7. Motility determination - Hanging drop method, Semisolid agar
8. Media preparation
   i. Liquid media - Peptone water, Nutrient broth
   ii. Solid media - Nutrient agar (Agar slant, Agar plate and Agar deep)
9. Culture characteristics of microorganisms
10. Demonstration of pigment production on nutrient agar medium (*Staphylococcus aureus, Pseudomonas aeruginosa* and *Serratia* spp.)
11. Pure culture technique - Pour plate, Streak plate and Spread plate
12. Anaerobic cultivation (Candle Jar and Pyrogallol methods)

REFERENCES

CORE PRACTICAL – II
(End of the second year)

1. Isolation of Genomic DNA (crude method)
2. Isolation of Auxotrophic mutant by replica plate method
3. Isolation of drug resistant mutants by gradient plate method
4. Examinations of Blood Cells
   i. Total Count
   ii. Differential Count
5. Blood collection and plasma/serum separation
6. Blood grouping - Rh typing –Cross matching
7. Precipitation reaction
   i. RPR card test / VDRL test.
   ii. Ouchterlony double immunodiffusion test
   iii. Counter immunoelectrophoresis
8. Agglutination reaction
   i. Widal test
   ii. ASO test
   iii. RA test
   iv. CRP test
   v. Pregnancy test (Direct/Indirect)
9. Demonstration of HBsAg by Hepacard test
10. Demonstration of HIV by Tri - dot test

REFERENCES
1. Myer’s and Koshy’s manual of diagnostic procedures in medical microbiology and immunology/serology. Published by department of clinical microbiology, CMC and Hospital, Vellore, Tamil Nadu.
CORE PRACTICAL-III  
(End of the Third year)

1. Colony morphology of pathogenic bacteria on different selective media
2. Identification of pathogenic bacteria

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<td>vi. Urease activity</td>
<td>vi. Cholera – Red reaction</td>
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a) Staphylococcus aureus  
b) Escherichia coli  
c) Klebsiella pneumoniae  
d) Salmonella typhi  
e) Proteus vulgaris  
f) Pseudomonas aeruginosa

3. Normal saline/ Lugol’s iodine preparation for parasitic ova/cyst examination
4. Stool examination by saturated saline technique
5. Blood smear examination for Malarial parasite (Plasmodium vivax and P.malariae)
6. Culture methods of fungi
   i. Media usage – PDA, SDA, Corn meal agar
   ii. Moist chamber - Incubation method
7. Examination of fungi by Lactophenol cotton blue stain
8. Examination of by Candida albicans Gram’s stain, Germ tube test
9. Examination of Cryptococcus neoformans by Negative staining
10. AST – Kirby-Bauer disc diffussion method
11. Microscopic examination of curd
12. Methylene blue reductase test

REFERENCES


9. Myer’s and Koshy’s manual of diagnostic procedures in medical microbiology and immunology/serology. Published by department of clinical microbiology, CMC and Hospital, Vellore, Tamil Nadu.

CORE PRACTICAL - IV
(End of the third year)

1. Examination of plant diseases
   a. Tikka leaf spot
   b. Citrus canker
   c. Red rot of sugarcane
   d. Wilt of cotton
2. Enumeration of bacteria and fungi from soil
3. Study of morphology of Cyanobacteria
   a. *Ocillatoria* spp.
   b. *Nostac* spp.
   c. *Lynbya* spp.
   d. *Anabaena* spp.
4. Isolation of Nitrogen fixing bacteria from root nodules of legumes
5. Water portability test (SPC and MPN)
6. Isolation of bacteriophage from sewage
7. Paper (Pigments) and Thin layer chromatography (Amino acid and sugar)
8. SDS- PAGE Electrophoresis
9. Identification of viral antibodies/antigen through ELISA Technique
   a. HIV 1 & 2
   b. HBsAg
10. Antibiotic screening – Crowded plate technique
11. Determination of generation type using turbidity method
12. Batch fermentation using Erlenmeyer flask

REFERENCES


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