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**Department of Biology /General Biology**

**College of Science**

**University of Salahaddin**

**Subject: Microbial Physiology**

**Course Book – Third Class**

**Lecturer's: Asst. Prof. Dr. Hero M. Ismael (Theory)**

 **MSc. Neven Nawzad Rajab (Practical)**

**Academic Year: 2023 - 2024**

**Course Book**

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| **1. Course name** | **Microbial Physiology** |
| **2. Lecturer in charge** | **Asst. Prof. Dr. Hero Mohammad Ismael (Theory)****MSc. Neve Nawzad Rajab (Practical)** |
| **3. Department/ College** | **Biology/Science** |
| **4. Contact** | **e-mail hero.ismael@su.edu.krd****. neven.rajab@su.edu.krd** |
| **5. Time (in hours) per week**  | **Theory : 2 hours (2groups)****Practical: 2 hours (3 groups)= 6 hours** |
| **6. Office hours** | **Availability of the lecturer to the student during the week** |
| **7. Course code** |  |
| **8. Teacher's academic profile** **Dr. Hero Mohammad Ismael** | * **I graduate from Salahaddin University in 1996(Ranked 2th in collage) worked as assistant biology from 1997 for three years and assist in practical Immunology lab., practical botany lab., practical mycology lab., In 2002 I finished my MSc degree and start as Assistant Lecturer Teaching Practical Mycology, Practical Cell Biology, Practical Botany, and Practical Entomology.**
* **In 2009 I got my PhD degree in Mycology and since then, I am in charge as a lecturer in teaching Mycology theory for 3rd class students, teaching Microbial Physiology theory for 3rd class students, Supervising Mycology and Microbial Physiology Practical Laboratory, Teaching Advanced Immunology for Graduate student**
* **For 5 years (in 2005 and Between 2009-2013) I worked as a Member of the Examination Committee for College of Science.**
* **I teach Microbial Physiology, Mycology, Microbial toxins and Microbial Ecology for Master students in biology and Environment departments.**
* **I teach Microbial Physiology and Microbiology for Ph D students in biology departments.**
* **I supervised 2 master students and one higher diploma.**
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| **8. Teacher's academic profile** **Nareen Qadr Faqi** | * **I graduate from Salahaddin University in 2003 (Ranked 8th in Department) worked as assistant biology for four years and assist in practical mycology lab., practical plant disease lab, practical General plant lab., practical ecology lab. and practical pollution lab.. In 2010 I finished my MSc. degree and start as Assistant Lecturer Teaching Practical mycology, Practical microbial physiology, Practical ecology, Practical pollution, and Practical general plant.**
* **For 4 years (Between 2011-2014) I worked as a Member of the Committee of Health & Safety for College of Science.**
* **I worked for 2 years as a Member of the Examination Committee for College of Science in (2011-2012) and (2012-2013)**
* **l have 5 papers publish in international journals**
* **In 2013 I get my lecturer degree in Mycology**
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| **8. Teacher's academic profile** **Neven Nawzad Rajab** | * **I graduate from Salahaddin University in 2005 (Ranked 8th in Department) worked as assistant biology for four years and assist in practical mycology lab., Practical soil and sewage Microbiology, practical ecology lab. and practical pollution lab..**
* **In 2011 I finished my MSc. degree and start as Assistant Lecturer at 2011 Teaching Practical general Microbiology, Practical microbial physiology, Practical ecology and Practical pollution.**
* **I worked a years as a Member of the Examination Committee for College of Science in (2016-2017).**
* **In 2013 I get my lecturer degree in Mycology**
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| **9. Keywords** | **Microbial physiology, Microorganisms, Structure, Factors affecting microbial growth Infection, antimicrobial agents and Microbial Metabolism** |
| **10. Course overview:** **Microbial Physiology** Is a writing intensive course. Subjects include bacteria, Archaea, Actinomycetes and Fungal structure, function and physiology, growth, reproduction, Metaboilsm and Microbial toxins and virulence factors.The importance of studying the subject The course will cover bacteria, Archaea, Actinomycetes and Fungi topics together with printed media and internet articles which deal with advantage and disadvantage of the fungi, general characteristics of fungi, reproduction of fungi (sexual and asexual) and fungal taxonomy. Instructional strategies attempt to strike a balance between developing the students ability to cope with fungi, extending their general academic reading skills, and increasing their basic knowledge of and understanding of fungi. The course will give students a better understanding of a number of important mycological topics, the followings are examples but not restricted to: importance (advantage and disadvantages), general characteristics, growth, Reproduction, Life cycles, Evolutionary relationships and Taxonomy of fungi.  |
| **11Understanding of the fundamental concepts of the course**Microbial Physiology is a branch of Microbiology, which involves the study of bacteria, Archaea, Actinomycetes and Fungal structure, growth, metabolism and toxins. Topics to be covered include Introduction and Course Overview, general characteristics of microorganisms structure, cell wall components, factors effecting the growth of MO, metabolism, toxins and microbial interactions.Major areas of the subject  Microbial Physiology is suitable for upper-level undergraduate and graduate students following courses in Microbiology |
| **12. Course objective:** The course will cover Microbial Physiology texts topics with print media and internet articles including schematic diagrams, images and movies that deal with the field of microbial physiology that expanded at an incredibly rapid pace since the last edition of this text. To give full measure to the extraordinary advances made in microbial physiology. The development and implementation of new, highly sophisticated, techniques to study the molecular genetics and physiology of an ever broadening range of microbes has prompted to study this field of the science. The lectures consider with the bacterial structures, microbial growth, nutrition requirements, the factors that affecting growth, micro and macronutrient, enzymes and the metabolism pathways of the microorganism, intermediary metabolism; also deals with antibiotics and toxins production by these microbes. One of the benefits of students taking Microbial Physiology course is that they will become more familiar with the microbial metabolism, and to better appreciate the elegant simplicities and the intricate complexities of microbial physiology, while at the same time realizing that there is still much to be learned.  |
| **13. Student's obligation  Exam policy:** Student should get at least 2 exam during the course (semester). There will be no make-up exams for absence students without medical report. Classroom polices: 1- Attendance: You are strongly encouraged to attend class on a regular basis, as participation is important to your understanding of the material. This is your opportunity to ask questions. Students are responsible for obtaining any information they miss due to absence. 2- Lateness: Lateness to class is disruptive 3- Electronic devices: All cell phones are to be turned off at the beginning of class and put away during the entire class. 4-Talking: During class please refrain from side conversations. These can be disruptive to other students and the professor, and not Disrespectful to both the professor and to other studentsThe course will cover Microbial Physiology practices with print media and internet references. To give full measure to the extraordinary advances made in microbial physiology. The development and implementation of new, highly sophisticated, techniques to study the physiology of an ever broadening range of microbes has prompted to study this field of the science. The lab consider with the Microbe structures, microbial growth, nutrition requirements, plant secondary metabolites, the factors that affecting growth of microbe such as fungi (yeast and mold) and Bactria, micro and macronutrient, enzymes and the metabolism pathways of the microorganism, intermediary metabolism; also deals with antibiotics and toxins production by these microbes. One of the benefits of students taking Microbial Physiology course is that they will become more familiar with the microbial metabolism, and to better appreciate the elegant simplicities and the intricate complexities of microbial physiology, while at the same time realizing that there is still much to be learned. |
| **14. Student's obligation*** **Exam policy:** Student should take 2 exams during the course; there will be no make-up exams for absences students without medical report.
* **Classroom polices:**
1. **Seminar:** each student should make a seminar and report and represent it in the practical class lab
2. **Attendance:** You are strongly encouraged to attend class on a regular basis, as participation is important to your understanding of the material. This is your opportunity to ask questions. You are responsible for obtaining any information you miss due to absence
3. **Lateness:** Lateness to class is disruptive
4. **Electronic devices:** All cell phones are to be turned off at the beginning of lab. and put away during the entire lab.
5. **Talking:** During class please lesson to side conversations. These can be disruptive to your fellow students and your lecturers
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| **15. Forms of teaching****White board, power points and some scientific movie or animation.** |
| **16. Assessment scheme*** **that the final grade will be based upon the following criteria:**
* **Practical Examination: 35**
* **Theory examination: 15**
* **Final examination theory: 50**
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| **17. Student learning outcome:**After completion of this course, you will be able to: Define common terms used in Microbial physiology and Microbial metabolism* Effects of chemical and physical factors on microbial growth
* Introduction, production and effects of antibiotics and antifungal agents on Microorganisms.
* Microbial metabolisms
* Introduction to Mycotoxins produce by fungi their effects and structure
* Microbial positive and negative association in their natural environment
* Microbial virulent factors and their mechanism for pathogenicity

Spore dormancy, activation and germination |
| **18. Course Reading List and References‌:**1. A. G. Moat, J. W. Foster, and M. P. Spector (2002). **Microbial Physiology**, 4th edition.
2. D. H. Griffin (1981). **Fungal Physiology**.
3. T. D. Brock (1990). **Biology of Microorganisms**, 2nd edition, prentice-Hall, Inc.
4. G. C. Ainsworth and A. S. Sussman (1969). **The Fungi (The Fungal Cell)**, Academic Press
5. R. W. Bauman (2007). **Microbiology with diseases by Taxonomy**, 2nd Edition.
6. D. T. Wicklow and B. E. Soderstrom (1997). **The Mycota (Environmental and Microbial Relationships)**. Springer.
7. G. N. Cohen (2011). **Microbial Biochemistry**. 2nd Edition, Springer
8. L. M. Prescott, J. P. Harley and D. A. Klein (2018). **Microbiogy**, 6th Edition. McGraw-Hill.
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| **19. The Topics:** | **Lecturer's name** |
| In this section the lecturer shall write titles of all topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture Each term should include not less than 16 weeks  | Lecturer's nameex:(2 hrs) |
| **20. Theory Topics** |  |
| Introduction, course outline of the Science of Microbial PhysiologyMicrobial GrowthGrowth curve | Week 1: Monday |
| Factors affecting growthPhysical factors:Temperature Osmotic pressurepH, RadiationChemical factors:CO2, O2, H2OFungicidesAntibiotics | Week 2: Monday |
| Nutritional requirementsMacronutrient: Carbon, Nitrogen, Phosphorus,, Sulfur, Potassium, MagnesiumMicronutrient: Copper, Iron, Manganese, Zinc, Molybdenum | Week 3: Monday: |
| Transport of solutesPassive diffusionFacilitated diffusionActive transport and co-transportGroup translocation | Week 4: Monday |
| Microbial metabolismEmbden-Meyerhof-Parnas (EMP) pathway Homofermentative organismHeterofermentative organism | Week 5: Monday |
| RespirationThe Tricarboxylic acid cycle (TCA)The Respiratory chain  | Week 6: Monday  |
| Entner- Duodoroff (ED) Pathway Phosphoketolase Pathway (Warburg-Dickens- Horecker)  | Week 7: Monday |
| Pentose Phosphate Pathway (PPP)Energetic of biosynthesisGluconeogenesis | Week 8: Monday |
| Metabolism of Autotrophs Chemolithitrophy Photoautotrophy | Week 9: Monday |
| Fungal toxinsToxins drived from aminoacids Ergotamine, Lysergic acid and Ergot alkaloidAromatic and Phenolic toxinsAflatoxins and Trichothecens | Week 10: Monday |
| Bacterial toxinsExotoxinsEndotoxins | Week 11: Monday  |
| Microbial Specific Mechanisms:Quorum sensingBiofilm formationSporulation | Week 12: Monday  |
| Interaction between organismsNeutralismCommensalismMutualismSynergismCompetitionParasitism  | Week13: Monday |
| Microbial pathogenisityBacterial virulent factors Fungal virulent factors | Week14: Monday |
| Exam | Week15: Monday |
| **21. Practical Topics (If there is any)** |  |
| **Topics** | **Date** |
| First week: Course Program, Preparation of media for microbial isolation | 23 /1 /2024 |
| Second week: Effect of Nutrition on microbial growth | 30 /1 /2024 |
| Third week: Effect of oxygen on microbial growth: using different methods of aerobic and anaerobic incubation |  6 /2 /2024 |
| Fourth week: Effect of temperature on microbial growth |  13/2 /2024 |
| Fifth week: Effect of pH on microbial growth | 20 /2 /2024 |
| Sixth week: Effect of osmotic pressure on microbial growth | 27 /2 /2024 |
| Seventh week: Practical examination | 5 /2/2024 |
| Eighth week: Effect of ultraviolet light on microbial growth | 26 /3 /2024 |
| Ninth week: Microbial relationship | 2 /4/2024 |
| Tenth week: Production of antibiotic by Microorganism |  9 /4/2024 |
| Eleventh week: Effect of chemical agents on microbial growth | 16/4/2024 |
| Twelfth week: Effect of plant extract on the growth of microorganisms |  23/ 4/2024 |
| Thirteenth week: Minimal Inhibitory Concentration (MIC) |  30 /4/2024 |
| Fourteenth week: Mechanism of survival, Sporulation, , dormancy, activation and germination | 7 /5/2024 |
| Fifteenth week: Microbial pathogenisity, Bacterial virulent factors, Fungal virulent factors |  14/5/2024 |
| Sixteenth week: Practical examination |  18 /5/2024 |
| **19. Examinations:****Theory:**Compositional: In this type of exam the questions usually starts with Explain how, What are the reasons for…?, Why…?, How….?Some example as following * Define Nystatin? What is the purpose for using it? And its source mention about its source and the mechanism of action?
* Explain why during preparation of media agar is used more than gelatine?

 * Define Semi-solid media? And for what purpose it is use?
* Write the chemical compounds of Potato Dextrose Agar (PDA)

***Fill the blanks:***1. Capnophiles such as …………….…. sp. require at least ……………… carbon dioxide in the atmosphere to initiate growth.
2. Temperature is the most important factor that determines..........................,.......................,..............................and...................... of all living organisms
3. According to their temperature ranges for growth of Microorganisms, we can be grouped into...................,....................and..........................
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| **20. Extra notes:**Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks. |
| **21. Peer reviewپێداچوونه‌وه‌ی هاوه‌ڵ** This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.*(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).*ئه‌م کۆرسبووکه‌ ده‌بێت له‌لایه‌ن هاوه‌ڵێکی ئه‌کادیمیه‌وه‌ سه‌یر بکرێت و ناوه‌ڕۆکی بابه‌ته‌کانی کۆرسه‌که‌ په‌سه‌ند بکات و جه‌ند ووشه‌یه‌ک بنووسێت له‌سه‌ر شیاوی ناوه‌ڕۆکی کۆرسه‌که و واژووی له‌سه‌ر بکات.هاوه‌ڵ ئه‌و که‌سه‌یه‌ که‌ زانیاری هه‌بێت له‌سه‌ر کۆرسه‌که‌ و ده‌بیت پله‌ی زانستی له‌ مامۆستا که‌متر نه‌بێت.‌‌  |