#### Course Title: Plant Disease Biotechnology

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| **University** | **Benha** |
| **Faculty** | **Agriculture** |
| **COURSE SPECIFICATIONS:** |
| Program of which the course is given | Agricultural Biotechnology |
| Major or Minor element of program |  |
| Departments offering the program |  |
| Department offering the course | Plant Pathology (Formerly: Agricultural Botany) |
| Academic year (level) | 4th |
| Date of specification approval |  |

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| **A- BASIC INFORMATION**  |
| Title  | Plant Disease Biotechnology |
| Code | AB0809 |
| Credit Hours  | 3 |
| Lecture | 2 Hours / week |
| Practical | 2 Hours / week  |
| Total: | 56 (14 weeks) |

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| **B- PROFESSIONAL INFORMATION** |
| 1. OVERALL AIMS OF COURSE |
| 1. Introduce students to the basic principles and concepts of plant biotechnology.
2. Familiarize students with the basic vocabulary of biotechnology and plant disease management.
3. Introduce and illustrate the major groups of organisms that cause plant diseases.
4. Familiarize students with certain local plant diseases’ symptoms, causal organisms, development and spread.
5. Provide a framework that students can use in their profession to best approach plant disease management.
6. Improve the written and oral communication skills of students through class, group and individual projects.
7. Prepare students for additional classes in Plant Pathology and related disciplines.
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| 2. INTENDED LEARNING OUTCOMES OF COURSE (ILOs) |
| **A. Knowledge and Understanding:** |
| ***By the end of the course, the student will be able to:***1. Demonstrate knowledge and understanding of concepts and terminology of tissue culture and genetic engineering and their importance in the areas of plant biotechnology.
2. Demonstrate knowledge and understanding of the basic concepts and principles of host-pathogen relationship.
3. Be familiar with the various mechanisms of plant resistance to pathogens on the molecular level.
4. Demonstrate knowledge and understanding of the resistance genes and their applications to fungal disease control.
5. Demonstrate knowledge of gene cloning technologies and the techniques used in plant transformation and their application in plant disease management.
6. Demonstrate knowledge of specific examples of genetic manipulation of plants for disease resistance.
7. Describe the different techniques and tools in genetic engineering.
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| **B. Intellectual Skills:** |
| ***By the end of the course, the student will be able to:***1. Use the proper terms related to different disciplines of biotechnology.
2. Compare and contrast between major techniques of biotechnology regarding their availability, advantages and disadvantages.
3. Select appropriate biotechnology tool to control specific disease.
4. Plan a plant disease management strategy based on the knowledge and understanding of biotechnology.
5. Evaluate the role of biotechnology in plant disease management.
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| **C. Professional and Practical Skills:** |
| ***By the end of the course, the student will be able to:***1. Practice the most common lab techniques of genetic engineering such as protein, DNA and RNA isolation and electrophoresis, plasmids extraction, bacterial transformation, PCR analysis.
2. Diagram a pathway of cloning a gene of interest from one plant to another.
3. Employ the biotechnology to protect plants from specific disease.
4. Employ the biotechnology in agriculture in order to improve crop quality and quantity.
5. Apply the concept of tissue culture for developing pathogen-free plants.
6. Apply the concept of genetic engineering for enhancing disease resistance of plants to pathogens.
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| **D. General and Transferable Skills:** |
| ***By the end of the course, the student will be able to:***1. Adopt ethics and biosafety guidelines regarding developing genetically-modified plants.
2. Work effectively in teams for preparing the biotechnology related projects.
3. Practice independent learning needed for continuous professional development based on continuous searching the internet and reading from textbooks.
4. Demonstrate creativity and time management abilities in preparing the specified project.
5. Retrieve information from textbooks and from the internet sources to improve professional competencies.
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| 3. CONTENTS |
| **Topic** | **No. of hours** | **Lectures** | **Practical** |
| 1. Importance and role of biotechnological tools in plant pathology.
 | 4 | 2 | 2 |
| 1. Basic concepts and principles of host-pathogen relationship.
 | 4 | 2 | 2 |
| 1. Molecular basis of host-pathogen interaction.
 | 4 | 2 | 2 |
| 1. Fungi, bacteria and virus recognition systems
 | 4 | 2 | 2 |
| 1. Signal transduction.
 | 4 | 2 | 2 |
| 1. Induction of defense responses.
 | 4 | 2 | 2 |
| 1. Pathogenesis related proteins, HR, reactive oxygen species, phyto-alexins and systemic acquired resistance. Programmed cell death.
 | 4 | 2 | 2 |
| 1. Viral-induced gene silencing.
 | 4 | 2 | 2 |
| 1. Molecular basis of gene-for-gene hypothesis; R-gene expression and transcription profiling.
 | 4 | 2 | 2 |
| 1. Mapping and cloning of resistance genes and marker-aided selection, pyramiding of R genes.
 | 4 | 2 | 2 |
| 1. Biotechnology and disease management: Development of disease-resistant plants via genetic engineering. Gene transfer and biosafety issues.
 | 4 | 2 | 2 |
| 1. Biotechnology and disease management: Role of tissue culture in giving pathogen-free plants.
 | 4 | 2 | 2 |
| 1. Biotechnology techniques: Protein, DNA and RNA isolation, Plasmids extraction, PCR analysis, DNA and Protein electrophoresis, bacterial transformation.
 | 4 | 2 | 2 |
| 1. Application of biotechnology in plant pathology.
 | 4 | 2 | 2 |

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| 4. TEACHING AND LEARNING METHODS |
| 1. The main subject areas are covered in the lectures (see syllabus plan).
2. Case study.
3. Cooperative groups.
4. Brain storming.
5. Learning cycle.
6. Students are given a topic to research in small groups which they report as an oral presentation. Collective feedback on the strengths and weaknesses of the presentations are provided.
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| 5. STUDENT ASSESSMENT METHODS |
| ***Students will be evaluated by attendance, fulfillment and effort in exercises and presentations, and examination grades:***1. Laboratory work: to assess the ability of students to understand and perform basic laboratory techniques of biotechnology.
2. Assignments & students' portfolio: to assess the intellectual & general skills at plant biotechnology.
3. Mid-term exam: to assess the knowledge & understanding.
4. Practical exam: to assess the professional skills.
5. Final exam to assess the knowledge & understanding and intellectual skills.
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| 6. ASSESSMENT SCHEDULE |
| No | AssessmentAssessment | **Week** |
| 1 | Periodical exam  | 4, 8 |
| 2 | Practical exam | 12 |
| 3 | Oral exam | 13 |
| 4 | Final exam | 14 |

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| 7. WEIGHING OF ASSESSMENT |
| No | AssessmentAssessment | **%** |
| 1 | Periodical exam  | 15 |
| 2 | Practical exam | 15 |
| 3 | Oral exam | 10 |
| 4 | Final exam | 60 |
| TOTAL | 100 |

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| 8. LIST OF REFERENCES |
| 1. **Punja, Z. K., De Boer, S. H., and Sanfaçon, H. (Eds.), 2007.** Biotechnology and plant disease management. pp. 574, Cabi.

<https://books.google.com.eg/books?id=l54Nu70bIAMC&pg=PA462&lpg=PA462&dq=biotechnology+and+plant+disease+management+book&source=bl&ots=_zH1gw8AGi&sig=quW_z7sa0NSlsXkHNxTvELMbpJQ&hl=en&sa=X&ved=0ahUKEwiU9-KQs6bJAhXlnnIKHYTwBaAQ6AEITTAJ#v=onepage&q=biotechnology%20and%20plant%20disease%20management%20book&f=false>1. **Abbas, H.K**. **2005.** Aflatoxins and food safety. CRC Press, FL, USA.

<http://books.google.de/books?id=emu_XrA8oqIC&printsec=frontcover&dq=Aflatoxins+and+food+safety&hl=en&sa=X&ei=4Ef3UqiBNMOCtAa3s4CoAg&ved=0CEEQ6AEwAA#v=onepage&q=Aflatoxins%20and%20food%20safety&f=false> 1. **Singh, R. S. 2000.** Diseases of fruit crops. Science Publishers, Inc. Plymouth, UK. <http://books.google.de/books?id=tgl_-tu6rpgC&printsec=frontcover&dq=Diseases+of+fruit+crops&hl=en&sa=X&ei=80f3UonJOsHVtAbd0oGoDA&ved=0CC4Q6AEwAA#v=onepage&q=Diseases%20of%20fruit%20crops&f=false>
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| 9. FACILITIES REQUIRED FOR TEACHING AND LEARNING |
| 1. Teaching aids/materials: e.g. boards – overhead projector – data-show projector – stationary…etc.
2. Teaching room/hall.
3. Computers.
4. Facilities for site visits etc., which are necessary for teaching the course.
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| **Course Coordinators:**  | **Prof. Dr. Gehad Desouki** **Dr. Mohamed El-Habbak**  |
| **Date: / / 2015** |