**University of Gadjah Mada**

*Faculty of Forestry*
*Study Program of Doctor in Forestry Science*

# *Module Handbook*

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| **Name (Code)** | Root Physiology (KTDS22806) |
| ECTS \| Type \| Status | 7.5 \| Class lecture \| Elective |
| Semester \| OfL:OnL Ratio \| LMS | 1 \| 60:40 \| elok.ugm.ac.id |
| Pre-Requisite | - |
| Description of content | The Root Physiology course discusses various types of root systems, structural development, anatomy, histology and cytology of roots, root function and root metabolism in young and mature root cells, nutritional physiology of roots which includes the absorption and transport of water and minerals, the role and interactions of roots with various soil microorganisms (mycorrhiza, nitrogen-fixing bacteria, and non-symbiotic bacteria), as well as the role of roots in soil environmental problems including drought, salinity and oxygen deficiency. |
| Course Outcomes and PLO mandated | Finishing this course, student will be able to identify the role, structure and development of roots in plants (CLO1/PLO3), to compare the metabolism and stages of absorption of water and minerals by roots (CLO2/PLO3), to select treatments for physiological responses to plant roots under environmental stresses (CLO3/PLO4), and to determine the function and interaction of roots with soil microorganisms to support the growth of forest plants (CLO4/PLO7) |
| Lecturer(s) | 1. Dr. Winastuti DA<br>2. Dr. Handojo Hadi Nurjanto<br>3. Dr. Eny Faridah |
| Workload | Total workload per semester is for 14 weeks, with weekly activities: 2*(50' lectures, 60' structured activities, 60' independent study), and 2 mid exam and final exam weeks. |
| Learning Method | Class Lecture and Discussion |
| Student Learning Experience | Actively discuss the class material and research cases, structured assignment, group work, quiz, material reflection, review of literature and problem in forestry sectors |

Mapping CO-syllabus

| CLO | Syllabus | Learning form | Meetings |
|---|---|---|---|
| 1 | 1. Role, differences and interaction of roots with stems and leaves<br>2. Structure of primary and secondary roots<br>3. Development and architecture of the root system<br>4. Gymnosperm and angiosperm roots | Class lecture and discussion | 4 |
| 2 | 5. Metabolism and development of young and mature roots<br>6. Water absorption and transport<br>7. Mineral absorption and transport | Class lecture, discussion, assignment | 3 |
| 3 | 8. Roots and soil dryness<br>9. Roots and salinity<br>10. Roots and flooding | Class lecture, discussion, presentation | 3 |
| 5 | 11. Interaction of roots and soil organisms (mycorrhiza)<br>12. Interaction of roots and soil organisms (nitrogen-fixing bacteria)<br>13. Interaction of roots and soil microorganisms (non-symbiotic)<br>14. The role of roots in increasingly complex environmental conditions | Class lecture, discussion, presentation | 4 |

Assessment method

| Base of Evaluation | Component of Evaluation | CLO1 | CLO2 | CLO3 | CLO4 | Total (%) |
|---|---|---|---|---|---|---|
| Participative activity | Assignment, quiz | √ | √ | | | 30 |
| Cognitive & Psychomotoric | Mid exam | √ | √ | | | 30 |
| Case Study result | Final exam, presentation | | | √ | √ | 40 |

References


1. Kolek J & V Kozinka. 1992. Physiology of Plant Root System. Kluwer Academic Publishers, The Netherlands.
2. Emons AMC & T Katelaar. 2009. Root Hairs. Plant Cell Monographs. Germany.
3. Kroon H & EJW Visser (Eds). 2003. Root Ecology. Springer-Verlag, Berlin.
4. Nilsen ET & DM Orcutt. 1996. Physiology of Plants under Stress - Abiotic Factors. John Wiley & Sons, New York
5. Smit AL, AG Bengough, C Engels, M Noordwijk, S Pellerin & SC Geijn. 2000. Root Methods. A Handbook. Springer-Verlag, Berlin.