PEDAGOGICAL PROJECT OF THE MASTERS AND DOCTORAL COURSES OF THE POSTGRADUATE PROGRAM IN AGRICULTURAL ENGINEERING

1. Minimum credit hours and minimum course loads for curricular integration of compulsory and optional curricular units

The minimum required credit hours may be completed by: compulsory subjects in the concentration area; optional subjects in the concentration area; related optional subjects; optional complementary subjects; and creditable activities. In the updated Pedagogical Project, a minimum of 24 (twenty four) credits will be required for the Masters Course, of which 04 (four) correspond to compulsory subjects and 20 (twenty) to optional subjects, totaling a minimum of 408 hours in subjects. A minimum of 42 (forty-two) credits will be required for the Doctoral Course, of which 06 (six) correspond to compulsory subjects and 36 (thirty-six) to optional subjects, totaling a minimum of 714 hours in subjects.

Change in the minimum credit hours (CH) and course load (CL) according to the Previous Curricular Matrix and the New Curricular Matrix for the Masters Course in Agricultural Engineering

Previous Curricular Matrix	**CH**	**CL**		**New Curricular Matrix**	**CH**	**CL**
Minimum compulsory credits	12	204		Minimum compulsory credits	4	68
Minimum optional credits	20	340		Minimum optional credits	20	340
TOTAL - Minimum Credits Required	32	544		TOTAL - Minimum Credits Required	24	408

Change in the minimum credit hours (CH) and course load (CL) according to the Previous Curricular Matrix and the New Curricular Matrix for the Doctoral Course in Agricultural Engineering

Previous Curricular Matrix	**CH**	**CL**		**New Curricular Matrix**	**CH**	**CL**
Minimum compulsory credits	13	221		Minimum compulsory credits	6	102
Minimum optional credits	40	680		Minimum optional credits	36	612
TOTAL - Minimum Credits Required	53	901		TOTAL - Minimum Credits Required	42	714

The new curricular matrices of the Masters and Doctoral Degree Programs meet the minimum credit hours and course loads established in Resolution No. 024/2018 of CONAC/UFRB.

2. Description of the Supply of Curricular Units per Semester

Supply of Curricular Units of the Masters Course in Agricultural Engineering

Semester	Curricular Units				
1	CCA 728 Seminars on Irrigated Agriculture and Water Resources I	CCA 810 Dissertation Project in Agricultural Engineering	CCA 730 Mathematics Applied to Soil and Water Engineering	Optional 1	Optional 2
2	CCA 729 Seminars on Irrigated Agriculture and Water Resources II	CCA 808 Proficiency in English in Agricultural Engineering	Optional 3	Optional 4	Optional 5
3	CCA xxx Seminars on Irrigated Agriculture and Water Resources III	CCA 811 Teaching Internship in Agricultural Engineering	CCA 816 Qualifying Examination for Masters Candidates in Agricultural Engineering		
4	CCA 812 Oriented Research in Agricultural Engineering	CCA 404 Dissertation Defense and Awarding of Masters Degree in Agricultural Engineering			

Supply of Curricular Units of the Doctoral Course in Agricultural Engineering

Semester	Curricular Units				
1	CCA 728 Seminars on Irrigated Agriculture and Water Resources I	CCA 730 Mathematics Applied to Soil and Water Engineering	Optional 1	Optional 2	Optional 3
2	CCA 729 Seminars on Irrigated Agriculture and Water Resources II	CCA 817 Thesis Project in Agricultural Engineering	Optional 4	Optional 5	Optional 6
3	CCA xxx Seminars on Irrigated Agriculture and Water Resources III	CCA 808 Proficiency in English in Agricultural Engineering	Optional 7	Optional 8	Optional 9
4	CCA 811 Teaching Internship in Agricultural Engineering	CCA 818 Qualifying Examination for Doctoral Candidates in Agricultural Engineering			
5	CCA 812 Oriented Research in Agricultural Engineering	CCA 731 Research Development in Irrigated Agriculture and Water Resources			
6	CCA 819 Thesis Defense and Awarding of Doctoral Degree in Agricultural Engineering				

3. Curricular integration

MASTERS COURSE IN AGRICULTURAL ENGINEERING

Compulsory Subject	**Course Load**	**Credits**
CCA 728 Seminars on Irrigated Agriculture and Water Resources I	17	1
CCA 729 Seminars on Irrigated Agriculture and Water Resources II	17	1
CCA 730 Mathematics Applied to Soil and Water Engineering	34	2
Compulsory Activity	**Course Load**	**Credits**
CCA xxx Seminars on Irrigated Agriculture and Water Resources III	0	0
CCA 812 Oriented Research in Agricultural Engineering	0	0
CCA 810 Dissertation Project in Agricultural Engineering	0	0
CCA 811 Teaching Internship in Agricultural Engineering	0	0
CCA 808 Proficiency in English in Agricultural Engineering	0	0
CCA 816 Qualifying Examination for Masters Candidates in Agricultural Engineering	0	0
CCA 404 Dissertation Defense and Awarding of Masters Degree in Agricultural Engineering	0	0
Optional Subject	**Course Load**	**Credits**
CCA 721 Agricultural Instrumentation	68	4
CCA 722 Projects and Evaluation of Irrigation Systems	68	4
CCA 723 Salinity Management in Agriculture	68	4
CCA 724 Soil Water Dynamics	68	4
CCA 725 Water and Solutes in the Soil-Plant System	68	4
CCA 726 Quality, Treatment, and Reuse of Water	68	4
CCA 727 Geoinformation and Remote Sensing	68	4
CCA 732 Fundamentals of Irrigation and Drainage Engineering	68	4
CCA 733 Hydrology	68	4
CCA 734 Micrometeorology and Evapotranspiration	68	4
CCA 735 Hydraulics of Free and Forced Conduits	68	4
CCA 736 Drainage of Agricultural Land	68	4
CCA 737 Advanced Irrigation Management	68	4
CCA 738 Fertigation and Production in Protected Environment	68	4
CCA 739 Water Resources Planning and Management	68	4
CCA 740 Optimization of Water Use in Hydroagricultural Projects	68	4
CCA 742 Advanced Topics in Irrigated Agriculture and Water Resources	68	4
Creditable Optional Activity	**Course Load**	**Credits**
CCA xxx Publication of Scientific Work in Agricultural Engineering I	34	2
CCA xxx Publication of Scientific Work in Agricultural Engineering II	34	2
CCA xxx Publication of Scientific Work in Agricultural Engineering III	34	2
CCA xxx International Mobility in Agricultural Engineering	68	4
CCA xxx National Mobility in Agricultural Engineering	34	2

Minimum Credits Required on Compulsory Subjects	**4**
Minimum Credits Required on Optional Subjects	**20**
TOTAL - Minimum Credits Required	**24**

DOCTORAL COURSE IN AGRICULTURAL ENGINEERING

Compulsory Subject	**Course Load**	**Credits**
CCA 728 Seminars on Irrigated Agriculture and Water Resources I	17	1
CCA 729 Seminars on Irrigated Agriculture and Water Resources II	17	1
CCA 731 Research Development in Irrigated Agriculture and Water Resources	34	2
CCA 730 Mathematics Applied to Soil and Water Engineering	34	2
Compulsory Activity	**Course Load**	**Credits**
CCA xxx Seminars on Irrigated Agriculture and Water Resources III	0	0
CCA 812 Oriented Research in Agricultural Engineering	0	0
CCA 817 Thesis Project in Agricultural Engineering	0	0
CCA 818 Qualifying Examination for Doctoral Candidates in Agricultural Engineering	0	0
CCA 811 Teaching Internship in Agricultural Engineering	0	0
CCA 808 Proficiency in English in Agricultural Engineering	0	0
CCA 819 Thesis Defense and Awarding of Doctoral Degree in Agricultural Engineering	0	0
Optional Subject	**Course Load**	**Credits**
CCA 721 Agricultural Instrumentation	68	4
CCA 722 Projects and Evaluation of Irrigation Systems	68	4
CCA 723 Salinity Management in Agriculture	68	4
CCA 724 Soil Water Dynamics	68	4
CCA 725 Water and Solutes in the Soil-Plant System	68	4
CCA 726 Quality, Treatment, and Reuse of Water	68	4
CCA 727 Geoinformation and Remote Sensing	68	4
CCA 732 Fundamentals of Irrigation and Drainage Engineering	68	4
CCA 733 Hydrology	68	4
CCA 734 Micrometeorology and Evapotranspiration	68	4
CCA 735 Hydraulics of Free and Forced Conduits	68	4
CCA 736 Drainage of Agricultural Land	68	4
CCA 737 Advanced Irrigation Management	68	4
CCA 738 Fertigation and Production in Protected Environment	68	4
CCA 739 Water Resources Planning and Management	68	4
CCA 740 Optimization of Water Use in Hydroagricultural Projects	68	4
CCA 742 Advanced Topics in Irrigated Agriculture and Water Resources	68	4
Creditable Optional Activity	**Course Load**	**Credits**
CCA xxx Publication of Scientific Work in Agricultural Engineering I	34	2
CCA xxx Publication of Scientific Work in Agricultural Engineering II	34	2
CCA xxx Publication of Scientific Work in Agricultural Engineering III	34	2
CCA xxx International Mobility in Agricultural Engineering	68	4
CCA xxx National Mobility in Agricultural Engineering	34	2

Minimum Credits Required on Compulsory Subjects	**6**
Minimum Credits Required on Optional Subjects	**36**

TOTAL - Minimum Credits Required	**42**

Related subjects offered by other Postgraduate Programs of UFRB to be used as credits in the Masters and Doctoral Courses in Agricultural Engineering

Related Optional Subject	Original PGP
CET501 - Experimental Statistics	Agrarian Sciences
SCCA505.2 - Production Physiology (Postgraduate)	Agrarian Sciences
SCCA510 - Soil Biology	Agrarian Sciences
SCCA548 - Advanced Topics in Plant Physiology	Agrarian Sciences
SCCA603 - Plant Physiology	Agrarian Sciences
SCCA744 - Plant Ecophysiology	Agrarian Sciences
SCCA772 - Chromatographic Methods for Analysis of Bioactive Components	Agrarian Sciences
SCCA555 - Laboratory Techniques in Agricultural Microbiology	Agricultural Microbiology
SCCA685 - Water Resources Management	Management of Public Policies and Social Security
SCCA718 - Biometrics: Analysis and Interpretation of Morphoagronomic and Molecular Data	Plant Genetic Resources (PGR)
SCCA640 - Soil Physics	Soils and Quality of Ecosystems (SQE)
SCCA641 - Physiology and Biochemistry of Plants Under Stress	SQE
SCCA643 - Instrumentation for Chemical Analysis of Soil-Plant and Water	SQE
SCCA644 - Management and Conservation of Tropical Soils	SQE
SCCA645 - Mineral Plant Nutrition	SQE
SCCA646 - Environmental Pedology	SQE
SCCA648 - Recovery of Degraded Areas	SQE
SCCA649 - Soil-Plant Relationship	SQE
SCCA652 - GIS Applied to Ecosystem Planning	SQE
SCCA653 - Soils and Quality of Ecosystems	SQE
SCCA654 - Soil Chemistry	SQE
SCCA763 - Soil Organic Matter	SQE
SCCA777 - Soil Fertility	SQE

4. Description of Curricular Units

Unit	**SEMINARS ON IRRIGATED AGRICULTURE AND WATER RESOURCES I**
Level	Masters and Doctorate
Type of Offer	Subject
Nature	Compulsory Subject
UFRB Code	CCA 728
Credit Hours and Course Load	1 credit and 17 theoretical hours
Link	All Research Lines
Course Menu	Research methodology. Scientific methods, research stages, problem and hypotheses. Methodology and expected results. Techniques for the presentation of seminars and use of audiovisual resources; exhibition of current technical-scientific topics in the field of Agricultural Engineering, with emphasis on Irrigated Agriculture and Water Resources.
Bibliography	

Unit	**SEMINARS ON IRRIGATED AGRICULTURE AND WATER RESOURCES II**
Level	Masters and Doctorate
Type of Offer	Subject
Nature	Compulsory Subject
UFRB Code	CCA 729
Credit Hours and Course Load	1 credit and 17 theoretical hours
Link	All Research Lines
Course Menu	Presentation of thematic seminar by professor/researcher of the postgraduate program, visitor or guest. Presentation of a seminar on the theme of the Dissertation/Thesis Project by the regularly enrolled student.

Unit	**MATHEMATICS APPLIED TO SOIL AND WATER ENGINEERING**
Level	Masters and Doctorate
Type of Offer	Subject
Nature	Compulsory Subject
UFRB Code	CCA 730
Credit Hours and Course Load	2 credits and 34 theoretical hours
Link	All Research Lines
Course Menu	Solution of mathematical problems applied to soil and water engineering, aiming at the improvement of analysis techniques and formulation of models and solutions, used in the development of research in this area; functions of several variables; ordinary differential equations; Laplace transform; probability distributions; numerical calculation.

Unit	**RESEARCH DEVELOPMENT IN IRRIGATED AGRICULTURE AND WATER RESOURCES**
Level	Doctorate
Type of Offer	Subject
Nature	Compulsory Subject
UFRB Code	CCA 731
Credit Hours and Course Load	2 credits and 34 theoretical hours
Link	All Research Lines
Course Menu	Development of research project and production of scientific articles for publication in a quality journal (at least Qualis B2), on a topic of relevance not necessarily linked to the thesis project to be presented and submitted for defense and completion of the degree requirements; the minimum required scientific production, of 01 (one) article, must be linked to the orientation team and with participation, where appropriate, of undergraduate students linked or not to scientific initiation (SI) and course completion work (CCW); the subject will be available from the minimum credit completion required for doctoral degree; the article(s) do(es) not account for the minimum requirement established for the submission of articles originating from the defense thesis; for validation of the discipline (according to the qualitative aspect of the articles), the first author must be, necessarily, the enrolled student; for the purpose of qualitative evaluation, the articles may be preliminarily evaluated by Ad Hoc consultants.
Bibliography	Nonapplicable

Unit	**SEMINARS ON IRRIGATED AGRICULTURE AND WATER RESOURCES III**
Level	Masters and Doctorate
Type of Offer	Collective Activity
Nature	Compulsory Activity
UFRB Code	CCA XXX
Credit Hours and Course Load	0 credit and 0 h
Link	All Research Lines
Course Menu	Compulsory student participation in PPGEA seminar activities, including those from compulsory subjects: CCA 728 Seminars on Irrigated Agriculture and Water Resources I and CCA 729 Seminars on Irrigated Agriculture and Water Resources II.
Bibliography	Nonapplicable

Unit	**TEACHING INTERNSHIP IN AGRICULTURAL ENGINEERING**
Level	Masters and Doctorate
Type of Offer	Collective Activity
Nature	Compulsory Activity
UFRB Code	CCA 811
Credit Hours and Course Load	0 credit and 0 h
Link	All Research Lines
Course Menu	The Teaching Internship is an integral part of the postgraduate training, aiming at the preparation for teaching and the qualification of undergraduate teaching. Teaching internship activities should be compatible with the research line of the Postgraduate student, conducted under the guidance of professor or supervisor.
Bibliography	Nonapplicable

Unit	**PROFICIENCY IN ENGLISH IN AGRICULTURAL ENGINEERING**
Level	Masters and Doctorate
Type of Offer	Collective Activity
Nature	Compulsory Activity
UFRB Code	CCA 808
Credit Hours and Course Load	0 credit and 0 h
Link	All Research Lines
Course Menu	Evaluating skills and contents in a foreign language, necessary to fulfill the teaching and research activities of Postgraduate Courses Stricto Sensu; performance in reading, interpreting, and writing in a foreign language.
Bibliography	Nonapplicable

Unit	**DISSERTATION PROJECT IN AGRICULTURAL ENGINEERING**
Level	Masters
Type of Offer	Collective Activity
Nature	Compulsory Activity
UFRB Code	CCA 810
Credit Hours and Course Load	0 credit and 0 h
Link	All Research Lines
Course Menu	Elaboration of a Research Project according to the content requirements of the Postgraduate Program in Agricultural Engineering. The project must be approved by the designated Project Leader and must aim at the completion of a Masters Dissertation in Agricultural Engineering, compatible with the concentration area and research line of the Postgraduate Program in Agricultural Engineering and in accordance with the egress profile.
Bibliography	Nonapplicable

Unit	**THESIS PROJECT IN AGRICULTURAL ENGINEERING**
Level	Doctorate
Type of Offer	Collective Activity
Nature	Compulsory Activity
UFRB Code	CCA 817
Credit Hours and Course Load	0 credit and 0 h
Link	All Research Lines
Course Menu	Elaboration of a Research Project according to the content requirements of the Postgraduate Program in Agricultural Engineering. The project must be approved by the designated Project Leader and must aim at the completion of a Doctoral Thesis in Agricultural Engineering, compatible with the concentration area and research line of the Postgraduate Program in Agricultural Engineering and in accordance with the egress profile.
Bibliography	Nonapplicable

Unit	**QUALIFYING EXAMINATION FOR MASTERS CANDIDATES IN AGRICULTURAL ENGINEERING**
Level	Masters
Type of Offer	Collective Activity
Nature	Compulsory Activity
UFRB Code	CCA 816
Credit Hours and Course Load	0 credit and 0 h
Link	All Research Lines
Course Menu	Student evaluation on the mastery of the themes studied in the curricular units and their technical qualification in the defense of the Dissertation research project.
Bibliography	Nonapplicable

Unit	**QUALIFYING EXAMINATION FOR DOCTORAL CANDIDATES IN AGRICULTURAL ENGINEERING**
Level	Doctorate
Type of Offer	Collective Activity
Nature	Compulsory Activity
UFRB Code	CCA 818
Credit Hours and Course Load	0 credit and 0 h
Link	All Research Lines

Course Menu	Student evaluation on the mastery of the themes studied in the curricular units and their technical qualification in the defense of the Thesis research project.
Bibliography	Nonapplicable

Unit	**DISSERTATION DEFENSE AND AWARDING OF MASTERS DEGREE IN AGRICULTURAL ENGINEERING**
Level	Masters
Type of Offer	Individual Activity
Nature	Compulsory Activity
UFRB Code	CCA 404
Credit Hours and Course Load	0 credit and 0 h
Link	All Research Lines
Course Menu	Student evaluation on the writing and defense of his/her Masters Dissertation. Student evaluation on the fulfillment of all requirements for awarding of Masters Degree in Agricultural Engineering, as provided in the Internal Rules.
Bibliography	Nonapplicable

Unit	**THESIS DEFENSE AND AWARDING OF DOCTORAL DEGREE IN AGRICULTURAL ENGINEERING**
Level	Doctorate
Type of Offer	Individual Activity
Nature	Compulsory Activity
UFRB Code	CCA 819
Credit Hours and Course Load	0 credit and 0 h
Link	All Research Lines
Course Menu	Student evaluation on the writing and defense of his/her Doctoral Thesis. Student evaluation on the fulfillment of all requirements for awarding of Doctoral Degree in Agricultural Engineering, as provided in the Internal Rules.
Bibliography	Nonapplicable

Unit	**FUNDAMENTALS OF IRRIGATION AND DRAINAGE AGRICULTURAL ENGINEERING**
Level	Masters and Doctorate

Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 732
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Irrigated agriculture worldwide and in Brazil. Importance of irrigation and drainage of agricultural land for sustainable agricultural production. Soil-water relationship (principles of soil physics and chemistry). Water-soil-plant relationship (principles of water relations of plants). Principles of water quality for irrigation. Irrigation methods and systems. Drainage methods and systems. Selection and criteria of engineering projects. Hydraulics applied to engineering projects. Cost-benefit ratio (principles of economics applied to hydroagricultural projects). Current technologies for irrigation management (intelligent agriculture). Water use efficiency in agriculture. Environmental benefits and impacts of irrigation. Management principles and mitigating measures.

Unit	**HYDROLOGY**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 733
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Hydrological cycle. Physical characteristics of watersheds. Rainfall. Surface runoff. Flow measurement and estimation. Ecological flow. Acquisition of hydrological data. Forecasting extreme events. Reservoirs. Underground water and wells.

Unit	**MICROMETEOROLOGY AND EVAPOTRANSPIRATION**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 734
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	The atmosphere: spatial and temporal scale of phenomena; structure of the atmosphere; mass and energy balance and storage in the atmosphere; turbulence phenomena in the planetary boundary layer. Near-surface radiation balance: radiation laws; shortwave radiation (direct and diffuse); longwave radiation; daytime, nighttime, and daily net radiation; global balance of the Earth-Atmosphere system. Nonradiative energy exchanges: sensible heat: thermal regime of the soil and air; latent heat: air humidity, atmospheric water vapor; rainfall; evaporation. Atmospheric movements: wind; atmospheric instability, Richardson number; momentum transfer; wind profile in vegetated and nonvegetated areas; advection. Mass and energy balance in plant communities. Micrometeorology of evaporation and transpiration (ET): measurements and estimates. ET in watersheds and agricultural areas.

Unit	**HYDRAULICS OF FREE AND FORCED CONDUITS**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 735
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Fundamental equation of hydrostatics. Efforts on submerged surfaces. Manometry. Fluid dynamics. Equation of continuity. Bernoulli equation. Forced conduits: properties, loss of load, gravity feeders, distribution systems, sizing. Settlement systems: classification, principles of operation, characteristic and pump operating curves, suction limits, sizing. Gravity pump. Free conduits: energy equation, critical regime, uniform flow, gradually varying flow, rapidly varying flow. Hydraulic structures: level regulators; speed regulators; flow regulators; measuring, bypass, and water distribution structures. Security devices. Hydraulic jump. Backwater curves. Energy dissipators. Equation of the resistance applied to nonuniform flow. Transitions in channels. Applications.

Unit	**PROJECTS AND EVALUATION OF IRRIGATION SYSTEMS**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 722
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Study of projects and operation of irrigation systems; evaluation of systems performance aiming at efficient water management; enabling the student to plan, design, and operate the various types of irrigation systems, considering the technical aspects of water application and economy for maximum profitability. Irrigation Hydraulics; conventional sprinkling; central pivot; self-propelled sprinklers; localized irrigation; gravity irrigation; efficiency, uniformity, adequately irrigated area. Indicators of irrigation quality and water productivity.

Unit	**DRAINAGE OF AGRICULTURAL LAND**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 736
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	General introduction. Evolution of irrigated agriculture worldwide and in Brazil. Importance of irrigation and drainage of agricultural land for sustainable agricultural production. Soil-water relationship (principles of soil physics and chemistry). Water-plant relationship (principles of water relations of higher plants). Water-atmosphere relationship (principles of atmospheric thermodynamics). Principles of water quality for irrigation. Storage, abstraction, and distribution of water for irrigation. Irrigation methods and systems. Drainage methods and systems. Selection and criteria of engineering projects. Hydraulics applied to engineering projects. Cost-benefit ratio (principles of economics applied to hydroagricultural projects). Environmental benefits and impacts of irrigation. Management principles and mitigating measures.

Unit	**ADVANCED IRRIGATION MANAGEMENT**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 737
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Concept of irrigation management. Theory of crop water requirements: evapotranspiration, crop coefficient. Irrigation scheduling methods: soil, plant, and climate indicators. Computerized irrigation management. Effective rainfall. Irrigation efficiency and uniformity. Production functions. Irrigation requirements at farm level and irrigated perimeters. Irrigation management of some crops: case studies. Deficit irrigation management.

Unit	**SALINITY MANAGEMENT IN AGRICULTURE**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 723
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Origin and classification of salt-affected soils. Physical and chemical aspects of soils of arid and semiarid regions. Effects of salinity on soil and on plant growth and development: toxicity, tolerance of plants to salinity. Quality of irrigation water and risks of soil salinization and sodification. Salinity profile resulting from irrigation, estimation of soil salinity and sodicity. Recovery and utilization of salt-affected areas. Prevention and control of salinity in irrigated areas.

Unit	**SOIL WATER DYNAMICS**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 724
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Properties of solids and fluids in the soil-water system. Energy and soil water retention. Soil water flow. Hydraulic soil conductivity. Soil water balance. Water extraction in the root zone. Modeling soil water dynamics.
Unit	**WATER AND SOLUTES IN THE SOIL-PLANT SYSTEM**
Level	Masters and Doctorate

Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 725
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Water and its cycle in agriculture; water structure; the importance of water for vegetables; physicochemical properties of water; water-solute interactions; water in biological reactions; water in the structures of macromolecules and membranes; water potential and its components. Water absorption by plants; water transport to the shoots; water transfer to the atmosphere; physiology of stomata; factors that affect the water flow in the soil-plant-atmosphere system. Water deficit in plants; mechanisms of resistance to drought; responses to water deficit. Saline stress in plants; effects of salinity on plants; plant responses to saline stress. Absorption, transport, redistribution, and assimilation of mineral nutrients by plants; the root environment and the acquisition of minerals; transport of ions through membranes; mineral pathway in the soil-plant system. Phloem flow; phloem sap composition; transport of solutes in the phloem.

Unit	**FERTIGATION AND PRODUCTION IN PROTECTED ENVIRONMENT**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 738
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Fundamentals of mineral plant nutrition. Benefits and impacts of fertigation. Sources of nutrients used in fertigation. Methods and equipment used in the application of fertilizers in irrigation systems. Fertigation and water quality. Preparation of fertilizer solutions. Control of nutrient leaching and prevention of soil salinization. Safety in the application of fertilizers via irrigation systems. Importance of fertigation in protected crops. Basic concepts and brief history of production in protected environment. Selection of different types of greenhouse. Protected environment and the Northeast region: difficulties and successful projects. Micrometeorological conditions in protected environment: characterization and control. Irrigation management in protected environment: methods and complicating factors. Irrigation management applied to pot, substrate, and hydroponic cultivation systems. Cultivation without soil. Hydrophysical characteristics of agricultural substrates. Hydroponics: production system and irrigation system. Commercial and noncommercial hydroponic production systems. Advantages, disadvantages, and limitations of hydroponics.

	Importance of hydroponics in scientific research. Preparation and management of nutritive solutions.

Unit	**QUALITY, TREATMENT, AND REUSE OF WATER**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 726
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Importance of water quality in irrigated agriculture. Guidelines on the quality of irrigation water: physical, chemical, and biological parameters. Problems of salinity and sodicity. Infiltration problems. Problems of toxicity and nutritional imbalances. Emitter clogging problems, disease transmission. Techniques for the use of lower-quality water. Legislation on water reuse. Potential and real benefits of water reuse. Wastewater operations, processes, and treatment systems. Practical examples of the rational use of wastewater in Brazil and worldwide.

Unit	**WATER RESOURCES PLANNING AND MANAGEMENT**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 739
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Water resources planning and management. Water resources management policy; Legislation on the use of water resources: water law and management; water as a resource; management of water resources: law No. 9,433/97; national water resources management system; sectoral legislation on water resources; international treaties on water resources; Interdisciplinarity: the methodology integrated in the preparation of water resources master plans. The Brazilian experience in the elaboration of master plans as tools for the management of water resources. Planning and management models: case studies.

Unit	**OPTIMIZATION OF WATER USE IN HYDROAGRICULTURAL PROJECTS**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 740
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Principles of economic analysis of irrigation projects. Priorities for irrigated agriculture; water productivity; volumetric efficiency of irrigation; productive efficiency and allocative efficiency of irrigation; economic analysis of irrigation; economic alternatives and investment analysis, uncertainty and risk; analysis of water-crop production functions; linear programming models for water allocation in irrigated agriculture; linear programming models for risk analysis. Response functions and deficient irrigation.

Unit	**GEOINFORMATION AND REMOTE SENSING**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 727
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Geoprocessing, geographic information systems, and remote sensing: brief history and introductory concepts. Principles of electromagnetic radiation. Aerophotogrammetry: history and elements of visual interpretation of images. Multispectral and hyperspectral remote sensing systems. Thermal remote sensing. Remote sensing of soil, vegetation, water, and urban areas. Digital image processing: hardware and software. Remote sensing applications: agriculture, management and preservation of natural resources, land cover and use, water resources - case studies.

Unit	**AGRICULTURAL INSTRUMENTATION**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 721
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Fundamentals of electrical measurements. Fundamentals of analog electronics. Fundamentals of digital electronics. Sensors for environmental monitoring. Data

	acquisition systems. Microcontroller measurement systems. Quantification of uncertainties in measurement systems.

Unit	**ADVANCED TOPICS IN IRRIGATED AGRICULTURE AND WATER RESOURCES**
Level	Masters and Doctorate
Type of Offer	Collective
Nature	Optional Subject
UFRB Code	CCA 742
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Up-to-date and relevant content with significant contribution to the scientific and technological development of irrigated agriculture and water resources; recent experiences of state-of-the-art methodological models, identified by a specialist with recognized scientific knowledge.

Unit	**PUBLICATION OF SCIENTIFIC WORK IN AGRICULTURAL ENGINEERING I**
Level	Masters and Doctorate
Type of Offer	Individual
Nature	Creditable Activity
UFRB Code	CCA xxx
Credit Hours and Course Load	2 credits and 34 h
Link	All Research Lines
Course Menu	Publication of a scientific article or literature review, necessarily in a scientific journal classified in the upper extracts of CAPES Qualis (concepts A1, A2 or B1) for Area of Agricultural Sciences I. For validation, the first author of the article must be the enrolled student, articles must have the presence of at least one permanent PPGEA professor, and the results must have been achieved during the course of the Program. In addition, there can be no overlap of the article foreseen in this curricular unit with that which must be derived from the curricular unit CCA 731 - Research Development in Irrigated Agriculture and Water Resources. The following will not be considered for crediting purposes: articles under submission; only already published articles will be considered. For journals not classified in Qualis/CAPES, the article validity for curricular crediting should pass through the PPGEA Collegiate, preferably with the consultation of an Ad Hoc rapporteur. The registration of a patent, process or technical production of high impact may replace the scientific article, as provided in the Internal Rules.
Bibliography	Nonapplicable

Unit	PUBLICATION OF SCIENTIFIC WORK IN AGRICULTURAL ENGINEERING II
Level	Masters and Doctorate
Type of Offer	Individual
Nature	Creditable Activity
UFRB Code	CCA xxx
Credit Hours and Course Load	2 credits and 34 h
Link	All Research Lines
Course Menu	Publication of a scientific article or literature review, necessarily in a scientific journal classified in the upper extracts of CAPES Qualis (concepts A1, A2 or B1) for Area of Agricultural Sciences I. For validation, the first author of the article must be the enrolled student, articles must have the presence of at least one permanent PPGEA professor, and the results must have been achieved during the course of the Program. In addition, there can be no overlap of the article foreseen in this curricular unit with that which must be derived from the curricular unit CCA 731 - Research Development in Irrigated Agriculture and Water Resources. The following will not be considered for crediting purposes: articles under submission; only already published articles will be considered. For journals not classified in Qualis/CAPES, the article validity for curricular crediting should pass through the PPGEA Collegiate, preferably with the consultation of an Ad Hoc rapporteur. The registration of a patent, process or technical production of high impact may replace the scientific article, as provided in the Internal Rules.
Bibliography	Nonapplicable

Unit	PUBLICATION OF SCIENTIFIC WORK IN AGRICULTURAL ENGINEERING III
Level	Masters and Doctorate
Type of Offer	Individual
Nature	Creditable Activity
UFRB Code	CCA xxx
Credit Hours and Course Load	2 credits and 34 h
Link	All Research Lines
Course Menu	Publication of a scientific article or literature review, necessarily in a scientific journal classified in the upper extracts of CAPES Qualis (concepts A1, A2 or B1) for Area of Agricultural Sciences I. For validation, the first author of the article must be the enrolled student, articles must have the presence of at least one permanent PPGEA professor, and the results must have been achieved during the course of the Program. In addition, there can be no overlap of the article foreseen in this curricular unit with that which must be derived from the curricular unit CCA 731 - Research Development in Irrigated Agriculture and Water Resources. The following will not be considered for crediting purposes: articles under submission;

	only already published articles will be considered. For journals not classified in Qualis/CAPES, the article validity for curricular crediting should pass through the PPGEA Collegiate, preferably with the consultation of an Ad Hoc rapporteur. The registration of a patent, process or technical production of high impact may replace the scientific article, as provided in the Internal Rules.
Bibliography	Nonapplicable

Unit	**INTERNATIONAL MOBILITY IN AGRICULTURAL ENGINEERING**
Level	Masters and Doctorate
Type of Offer	Individual
Nature	Creditable Activity
UFRB Code	CCA xxx
Credit Hours and Course Load	4 credits and 68 h
Link	All Research Lines
Course Menu	Recognition of merit according to activities carried out by the student in foreign institutions, during the period of the course in the Postgraduate Program in Agricultural Engineering. The activities must be included in a Plan previously approved by the PPGEA Collegiate, with the consent of the Advisor. The student will be approved/disapproved in the Subject according to the Mobility Report.
Bibliography	Nonapplicable

Unit	**NATIONAL MOBILITY IN AGRICULTURAL ENGINEERING**
Level	Masters and Doctorate
Type of Offer	Individual
Nature	Creditable Activity
UFRB Code	CCA xxx
Credit Hours and Course Load	2 credits and 34 h
Link	All Research Lines
Course Menu	Recognition of merit according to activities carried out by the student in national institutions, during the period of the course in the Postgraduate Program in Agricultural Engineering. The activities must be included in a Plan previously approved by the PPGEA Collegiate, with the consent of the Advisor. The student will be approved/disapproved in the Subject according to the Mobility Report.
Bibliography	Nonapplicable

Unit	**QUALIFYING EXAMINATION FOR DOCTORAL DEGREE IN AGRICULTURAL ENGINEERING**
Level	Masters

Type of Offer	Individual
Nature	Curricular Activity
UFRB Code	CCA xxx
Credit Hours and Course Load	0 credit and 0 h
Link	All Research Lines
Course Menu	Unit for students of the Masters Course in Agricultural Engineering interested in joining the Doctoral Program upon submission of a qualifying examination.
Bibliography	Nonapplicable

Unit	**POSTDOCTORAL INTERNSHIP IN AGRICULTURAL ENGINEERING**
Level	Postdoctorate
Type of Offer	Individual
Nature	Curricular Activity
UFRB Code	CCA xxx
Credit Hours and Course Load	0 credit and 0 h
Link	All Research Lines
Course Menu	Registration of postdoctoral activities in the Postgraduate Program in Agricultural Engineering, as required by Resolution No. 023/2018, which regulates the Postdoctoral Internship Program within UFRB.
Bibliography	Nonapplicable