Short Name of the University/Country code **Date (Month/Year)**	**AUP- BG** **2020**
TITLE OF THE Curricula/Module	**Code**
Using of SENTINEL1-2-3 imagery for agricultural field monitoring- 4 ECTS; 30 contact hours; 50 praxis; 45-student workload.	

Teacher(s)	**Department**
Coordinating: **Assoc. Prof. Zhulieta Arnaudova Ph.D** **Others:** **Ass. Prof. Vera Stefanova Ph.D**	Melioration, Land Surveying and Agrophysics AUP

Study cycle	**Level of the module**	**Type of the module**
BA/**MA**/PhD	Master	

Form of delivery	**Duration**	**Langage(s)**
offline	15weeks	English Bulgarian

Prere ıuisites	
Prerequisites: To know: Geodesy, Land Surveying and knowledge about land use Informatics, basics of GIS, Basic informatics skills To be able to: Use application of GIS – ArcGIS, QGIS	**Co-requisites (if necessary):**

ECTS (Credits of the module)	**Total student workload hours**	**Contact hours**	**Praxis**	**Individual workhours**
4	**125**	30	50	45

Aim of the module (course unit): competences foreseeen by the study programme

The Common Agricultural Policy (CAP) came into force in 1962 to ensure affordable food for European citizens and a fair standard of living for farmers. While this philosophy remains at policy's heart, the focus is also now firmly on sustainability, environmental protection, biodiversity and the climate. Sentinel-1 and Sentinel-2 missions will now be used to advance the CAP. Their data will make this important policy more efficient and easier to implement, and above all make the life of the farmers easier so that they have more time to focus on farming the food. Satellite monitoring is the missing link in a successful agribusiness chain. The use of satellite data and online analytical services are able to fill the gaps in the routine audit methods. They allow you to quickly get and assess information on any field.

Crop Monitoring is a universal tool for all the players of the agro market as you can find the field health monitoring, climate impact analysis, fertility management and crop yields modeling tools at

one-for-all Platform. It's hard to know how decisions are paying off without a reliable way of measuring results, so:

-farmers can use the platform to monitor weather conditions for minimizing related risks, plan and manage field works, prevent their field losses, use powerful analytic tools like vegetation indices (you can select the period for analysis) for proper decision making and to be on the forefront of farming technology with yield prediction;

-insurers can get easy access to field's historical data, farming records or land usage without visiting the field as these can be monitored directly in the platform

The aim of this course is to provide the knowledges of the methods and means of obtaining incoming digital information from satellites Sentinel-1, Sentinel-2, Sentinel-3. How to used it about the field - monitoring and mapping of boundaries, soils, spatial analyzes based on soil analysis and yield, as well as preparation of outgoing information to appropriate software. Using a GIS to read and analyze information. Creation and fill of technology maps in the field of plant growing, vegetable growing, viticulture, selection of suitable terrains for sustainable use of agricultural lands in the plant breeding industry.

Learning outcomes of module (course unit)	Teaching/learningmethods	Assessment methods
Toknow: Explore free open source toolboxes for the scientific exploitation of Earth Observation missions under the the Scientific Exploitation of Operational Missions (SEOM) programme element. To point To explain structure of SNAP, land monitoring services by Copernicus, Mosaic hub, PEPS To numerate Access to Global, Pan-European, Local, Imagery and reference data To recognize Copernicus land services from satellite images and in-situ data in order to create reliable products and services. To give examples: of	Lectures, presentations, seminars, practical lessons, self-study	Participation in discussions, course project Work with software Quiz
Using a digital information from Sentinel satellites for precision agriculture To describe: • basic methods for gathering information, database, georeferncing of spatial information, work with Mosaic hub, PEPS, SNAP, GIS software To formulate: basic principles, methods and tasks abou t using an information for precision agriculture		
To be able to: • To work with Mosaic hub,PEPS, SNAP, GIS software • Imagery and reference data • Queries, analysis and editing of the information	Implementation of the training project	Presentation of an educational project

• Technology maps • Modeling of information.		
Possess: Knowledge of using satellite imagery and in-situ data in order to create reliable products and services. Spatial analysis, modeling the data for land use to build to develop to evaluate different kind of analysis and take decisions	Implementation of the training project	Presentation of an educational project

Themes	Contactworkhours							Time and tasks for individual work	
	Lectures	Consultations	Seminars	Practiclwork	Laboratory work	Placements	**Total contact tw**	**Individual work**	**Tasks**
Sentinel satellites- introducing. Contributing mission	2			3	0	0	**5**	**5**	Contributing missions, Sentinel-1, Sentinel-2, Sentinel-3
Land Monitoring science by Copernicus **Global Land Services** – vegetation state (vegetation properties, indicators, productivity, soil water index) **Pan European imagery** – Natura 2000 **Local and Imagery and Reference data** – EU- DEM, EU-Hydro, European and Global Image Mosaic	3	1		6			**12**	**15**	Global imagery Local imagery Pan European Download and work with images

Free access data – STEP (Scientific Toolbox Exploitation Platform**)** **Mosaic hub –**Registration, Mosaic ordering, Mosaic Algorithm **SNAP –**Sentinel Application Platform Land Viewer EOS data analytics - Sentinel bands Vegetation Spectral Signature Obtaining Open- Access Sentinel Data for Vegetation Monitoring. Calculating of NDVI (Normalized Differenve Vegetation Index), NDWI (Normalized Differenve Water Index) LAI Leaf Area Index) in GIS. **Using a GIS** Calculating NDVI, NDMI, NDWI with ArcGIS	8	1		6			**13**	**25**	Mosaic hub Sentinel data hub SNAP –Sentinel ApplictionPlatform GloVIS LandViewer EOS
Total	14	1		15			**30**	**45**	

Assessment strategy	**Weight in %**	**Deadlines**	**Assessment criteria**
Running control 1	15	8 week	preliminary presentation of the project
Running control 2	70	14 week	Presentation of an educational project
Final exam	15	15 week	Final quiz

Compulsory literature Aut hor	**Year of issue**	**Title**	**No of periodical or volume**	**Place of printing. Printing house or internet link**
Arnaudova Zhulieta	2019	Using of SENTINEL1-2-3 imagery for agricultural field monitoring-	Lectures presentations	Electronic version
ESA				https://www.esa.int/ESA
PEPS				https://peps.cnes.fr
Copernicus Land Monitoring Services				https://land.copernicus.eu/
Meera Gandhi.G, S.Parthiban, Nagaraj Thummalu Christy. A,	2015	Procedia Computer Science 57 (2015) 1199 – 1210		https://reader.elsevier.com/reader/sd/pii/S1877050915

Toby N.Carlson, David A.Ripley,	1997	On the relation between NDVI, fractional vegetation cover, and leaf area index	Remote Sensing of Environment Volume 62, Issue 3, December 1997, Pages 241-252

Additional literature

https://glovis.usgs.gov/app
https://www.usgs.gov/centers/eros/science/usgs-eros-archive-sentinel-2?qt-science_center_objects=0#qt-science_center_objects
https://www.google.com/search?q=ndvi+%D0%B8%D0%BD%D0%B4%D0%B5%D0%BA%D1%81&rlz=1C1GGGE_bgBG602BG619&source=lnms&tbm=isch&sa=X&ved=2ahUKEwjC8LvcteDoAhUGV8AKHSgnAK4Q_AUoAXoECAsQAw&biw=1366&bih=608#imgrc=V5MNhK3WXc-rDM
https://eos.com/blog/6-spectral-indexes-on-top-of-ndvi-to-make-your-vegetation-analysis-complete/?utm_source=Email&utm_medium=educational_content&utm_campaign=button
https://eos.com/landviewer
https://eos.com/crop-monitoring
https://www.seos-project.eu/agriculture/agriculture-c01-s01.html
http://www.fao.org/giews/earthobservation/asis/index_2.jsp?lang=ru
https://www.youtube.com/watch?v=ma4OOnsEUcA
https://www.youtube.com/watch?v=CU-kfkrrDcY
https://www.youtube.com/watch?v=F3rsSq0-mmE

ANOTATION /course summery

The Common Agricultural Policy (CAP) came into force in 1962 to ensure affordable food for European citizens and a fair standard of living for farmers. While this philosophy remains at policy's heart, the focus is also now firmly on sustainability, environmental protection, biodiversity and the climate. Sentinel-1 and Sentinel-2 missions will now be used to advance the CAP. Their data will make this important policy more efficient and easier to implement, and above all make the life of the farmers easier so that they have more time to focus on farming the food.

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