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FOR SUSTAINABLE & RESILIENT ENVIRONMENTS

NEW STUDY PROGRAMME
MASTER STUDIES
URBAN ENERGY EFFICIENCY

Draft version 1.2

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PROGRAMME SCHEME

I semester

1.1 Energy efficiency in buildings and urban complexes

1.2 Energy efficiency of urban systems to climate changes

1.3 Energy efficency of transport in cities

1.4 Management of urban waste an recyclig

1.5 New renewable and adaptive sources of energy

1.6.a
Energy efficient and environment friendly building materials and technologies

1.6.b
Energy efficiency and municipal services

1.6.c
Energy efficiency and EU legisalative and sources of finances

II semester

2.1.
Preparation and defense of master thesis – energy efficiency in contemporary materials and technologies sector

2.2
Preparation and defense of master thesis – energy efficiency in urban systems to climate changes

2.3
Preparation and defense of master thesis – municipal management of energy efficiency

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PROGRAMME DESCRIPTION

- General description

Two programmes based primarely on problematic of energy efficiency were organized and conducted on SUNP. Although main topic were, not to say same but, similar in both cases, there were many differences in those programmes: type of programme, duration, focus, courses, etc. This programme suppose to upgrade both of previous programmes experiences focusing on urban problems of energy efficiency through connecting, adaptation and harmonization of all urban levels to provide synergy of all factors for impruvemenet of energy efficicncy in times of significant threats of climate changes today and needed resilience, flexibility and posibility of adaptation of all urban levels to these changes. This means that all strategies changes are to be orchestrated to lead to main goal – energy efficient home, building, neighborhood, district, town, city, metropolitan, region and country. There are two main coarses of acting: existing urban fabric and new devepments. There is also very important to include these strategies in legal documents and procedures adapted for both – existing urban units/ buildings/ neighborhoods/ districts/ towns/ cities/ metropolitan areas/ regions/ countries. It is also important to follow and understand wider context of European context, in both technicaly-technological level and legal procedures and regulation in this area, resiliently adopting best practices that are compatible with national and local legal regualtions and practices.

- Aims and objectives

Aims and objectivs are to: /

- provide possibilities for quality education in domain of building/urban efficiency and resilliency of
  - architects,
  - civil engineers
  - urban designes,
  - urban planners, with awareness of
    - climate changes and its impacts on
      - urban environment,
      - energy resources and
      - local practices in both:
        - new urban developms and
        - maintaning of the existing ones towards best recommendations and practices and, through the
          - practices of new designs,
          - adaptations,
          - reconstructions and
          - transformations of the
            - existing buildings
            - existing urban tissues by
              - local
              - state
              - EU
                - recommendations,
                - regulatios and finally
                - legislation.

- Purpose

  Main purpose is to provide architects, urban designers, planners, civil engineers avare of energy efficiency and resillincy with to be capable to follow and be resilient to day-to-day changes in overall climate and microclimate changes, to follow building materials and building technologies day-to-day novelties and possibilities to answer to these changes, and finally to be aware of positive nad progressive legislative imputs on all leveles from local/national/internationa by implementing them timely and also giving the feedbacks and improving timely local/national/international recommendation with new imputs as a result of best practices.

- Competencies

  Competences of Masters of Urban Efficiency are in the fields of
  - building materials and technologies (design, production, implementation),
  - building and urban systems efficiency (design, reconstruction/transformation, optimization),
  - transport efficiency (design, organisations, optimization),
  - urban waste management and recycling

to be used in
  - industires,
  - researches (in all above and following mentioned fields),
  - academec and
  - govermental/municipal areas of operation.

- Curriculum structure

I semester				
	Course	**hours l+e**	**type**	**ECTS**
1.1	Energy efficiency in buildings and urban complexes	3	m	5
1.2	Energy efficiency of urban systems to climate changes	3	m	5
1.3	Energy efficency of transport in cities	3	m	5
1.4	Management of urban waste an recyclig	3	m	5
1.5	New renewable and adaptive sources of energy	3	m	5
1.6a	Energy efficient and environment friendly building materials and technologies	3	el	5
1.6b	Energy efficiency and municipal services		el	
1.6c	Energy efficiency and EU legisalative and sources of finances		el	
	Total	18		30

II semester				
	Course	**L**	**type**	**ECTS**
2.1	Preparation and defense of master thesis – energy efficiency in contemporary materials and technologies sector	20	el	30
2.2	Preparation and defense of master thesis – energy efficiency of urban systems to climate changes	20	el	30
2.3	Preparation and defense of master thesis – municipal management of energy efficiency	20	el	30
	Total	20		30

- Duration

  Duration of Master studies is 1 year /two semeseters/total of 60 ECTS.

- Enrollment

  Students of Architecture, Civil Engineering, Urban Design and similar fields are encouraged to enroll on this Master studies. It is necessary to have completed 4 years of studies or 240 ECTS, or equivalent.

TABLE 1. DETAILED DESCRIPTION OF NEW COURSES (SUBJECTS)

s.n.	*Course title*	*Status*	*ECTS*	*Content*	*Methodology*	*Software/ Equipment*	*Coverage with the literature*
1.1	Energy efficiency in buildings and urban complexes	M	5	• Energy balance of buildings. Building envelope. • Ventilation and air-conditioning, heating and cooling systems in buildings. Light in buildings. • Energy efficiency of electrical devices. Centralized energy management in buildings and control. • Microcogeneration. • Renewable energy sources application in buildings. • Comfort parameters. • Energy efficiency measures in buildings. Energy examinations and certification of buildings. Green and passive buildings. • Examples of successful practice in Serbia and the world. • Energy efficiency principles in building of urban complexes (grouping, megastructues and other complexes).	theory classes practical exercises	DesignBuilder V4 Engineering Pro Package, EnergyPlus 8.4.0., thermal camera	satisfying
1.2	Energy efficiency of urban systems to climate changes	M	5	• Basic aspects of environment protection. • Regulations in the field of environment in Serbia and the EU. • General framework of Serbia's and EU policy in the field of environment.	theory classes		

				• Definition and importance of climate changes. • Impacts and policies in the sphere of climate changes. • Mitigation and adaptation actions, with special emphasis on energy. • Energy effiicient concepts in urban planning. • Sustainable urban development. • Energy efficicency principles in urban design. • Carbon free cities. • Examples from global practice.	practical exercises		weak
1.3	Energy efficency of transport in cities	M	5	• Transport – its contributio to global energy demand • Energy efficiency in the transport sector • System efficiency • Travel efficiency • Vehicle efficiency • Fuel energy efficiency • How to measure the energy efficiency of transport • The co-benefit approach • Energy efficiency policies and measures • Local authorities/Local companies/ National governments/Joining forces • Policy packages for energy –efficient urban transport • Step by step towards energy-efficient urban transport system	theory classes practical exercises		weak

				• Using of local potential • The path to an energy efficient urban transport system			
1.4	Management of urban waste an recyclig	M	5	• Waste characteristics • Integrated waste management /Waste Flow Diagram • Key concepts: zero waste, eco-efficiency, industrial ecology • Waste collection, transport and processing • Waste Storage • Street cleanning • Sanitary landfill • Reduce, Re-use & Recycle • Use of waste-dereived organic matter as a soil amendment • Composting • Biogasification • Incinereation and thermal conversion • Regulatory and economic instruments for solid waste management	theory classes practical exercises		
1.5	New renewable and adaptive sources of energy	M	5	• Introduction to renewable energy sources. • Greenhouse effect. Global heating. Extreme meteorological conditions. • Regulation of renewable energy sources. European Union directive on renewable energy sources. Renewable energy sources in Serbian legislation. • Solar energy. • Solar panel energy. Setting up solar	theory classes practical		satisfactory

				palens. Active and passive systems. • Geothermal energy. • Wind energy. • Water energy • Biomass energy. • Biomass processing technology (briquet, pellet, chip production...). • Animal husbandry production biomass.. • Advanced energy systems (fuel cells, hydrogen fuel). Waste recycling. • Processes of thermal and electric energy production from renewable energy sources. • Social and economic indicators of the use of renewable energy sources. Market development. Price policy.	exercises		

1.6 a	Energy efficient and environment friendly building materials and technologies	E	5	• Historical review of the use of building construction materials. • Characteristics of energy efficient and eco-friendly building materials. • Smart materials - advanced materials - self-healing materials-industrial coatings. • Application of Trespa Meteon panels (for facades, balconies and a wide range of other external applications). • Bubble Deck panels. • Adaptation of a geometric ball and network in concrete structures. • Self-forming structure resulting from the geometry of two well-known components: reinforcement and a hollow plastic ball. • YTONG материals fulfilling standards that enable buildings to have LEED (Leadership in Energy and Environmental Design) certifications. • Energy efficient building and raising ecological standards. • Lowering carbon monoxide emission (CO2). • Examples of successful practice in Serbia and the world.	theory classes practical exercises		satisfactory
1.6 b	Energy efficiency and municipal services	E	5	• Basic concepts on system efficacy. • Energy efficiency measures in various industry sectors; • Introduction of energy management and environment protection management in industrial companies; • energy efficiency in heat energy production in industrial companies; • efficient use of energy in steam distribution and condensate recovery	theory classes practical exercises		weak

				systems, • efficient use of energy in compressed air systems, bases of work on energy balances in industrial companies; • Energy efficiency local regulations • Directions for energy management at the local level. • Municipal services managing energy efficiency according to local regulation • Role of disemination of immportance of energy efficiency on local level • Recommendations of energy efficiency to new developers • Recommendations of energy efficinecy for existing users in older buildings. • Examples of successful practice in Serbia			
1.6 c	Energy efficiency and EU legisalative and sources of finances	E	5	• Concept and significance of energy efficiency. • Fields and methods of the application of energy efficiency on the consumption side (buildings, industry, transport, communal energy, households). • Co-generation. • Energy efficiency indicators. • Energy management principles. • Role of energy managers. • Directions for energy management at the local level. • Regulations in the field of energy efficiency in Serbia and the European Union. • ESCO models of EE financing.	theory classes, practical classes: omputation exercises		satisfactory

				• Energy efficiency awareness raising campaigns. • Examples of successful practice in Europe and the world.			
2.1	Preparation and defense of master thesis – energy efficiency in contemporary materials and technologies sector	E	30		work with mentor		
2.2	Preparation and defense of master thesis – energy efficiency of urban systems to climate changes	E	30		work with mentor		
2.3	Preparation and defense of master thesis – municipal management of energy efficiency	E	30		work with mentor		

Notes:

- *COLUMN 1: Abbreviation s.n. relates to the semester and the number of the course in that semester*
- *COLUMN 2: the title for every course*
- *COLUMN 3: to insert 'M' for mandatory subject or 'E' for elective subject*
- *COLUMN 4: the number of ECTS for every course*
- *COLUMN 5: to insert course content in bullet points and highlight in blue the themes to be supported by the learning material developed within the project. SELECTED CONTENT MUST BE JUSTIFIED WITH THE WEAK OR NOT EXISTING LITERATURE IN SUBJECT AREA (END RIGHT COLUMN IN THE TABLE).*
- *COLUMN 6: to insert foreseen teaching/learning methodology (methodologies) for every course (subject), for example: theory, exercises, workshop, field work, experimental work, etc.*
- *COLUMN 7: to insert details of the software / equipment necessary for the implementation of every separate course*
- *COLUMN 8: to insert the scope of coverage with relevant literature <u>both in English and in national language</u> (use one of the following 4 descriptors: abundant, satisfying, weak – less than 3 available units in the topic, or not existing) (for version 2 of the draft, all relevant literature units will be presented in detail)*