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Engineering Educators Pedagogical Training (ENTER)

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Syllabuses of iPET-2 courses

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ABSTRACT

This deliverable is dedicated to the iPET program for engineering educators' pedagogical training, and focuses on courses for iPET-2 module of the program. The paper provides a brief explanation of iPET program structure, as well as the background for the choice of courses and competences to be formed within such program. The deliverable discloses draft versions of syllabuses for iPET-2 courses: 2.1. Enhancement of learning interactivity, 2.2. Systems analysis in education, 2.3. Pedagogical psychology and communication, 2.4. Interaction with stakeholders, 2.5. Sustainable development. Each syllabus provides general information on the course (aim, objectives, content, teaching materials, etc.), structure of the course content and assessment procedures.

INTRODUCTION

This deliverable has been developed within the ENTER project, work package 2 (WP2) – "Development".

The initial task within WP2 was to develop a structure of the iPET program for pedagogical training of engineering educators. This task has been completed by the consortium partners by project meeting in Almaty in October, 2019.

It has been proposed to create 3 iPET modules within the program: iPET-1, iPET-2 and iPET-3. Each of the modules includes a certain set of courses aimed at fostering various competences of engineering educators.

In order to determine the set of courses and competences that should be fostered within the iPET program, the consortium has conducted a massive survey of stakeholders' opinions on this matter. The survey included 5 groups of stakeholders: engineering educators, HEI administration, HEI engineering students, potential employers of HEI engineering graduates and representatives of governmental bodies, involved in education. The number of respondents exceeded 800, representing over 25 regions of Russian Federation and Republic of Kazakhstan. Based on the results of the survey the following structure of iPET modules has been proposed and approved by the consortium:

iPET program	Module		Course	ECTU
iPET-1 (2 ECTU)	**A**	1.1	Innovations in engineering pedagogy	1
		1.2	Time management	0,5
		1.3	Effective interaction	0,5
iPET-2 (8 ECTU)	**A**		1.1, 1.2, 1,3	2
	B	2.1	Enhancement of learning interactivity	2
		2.2	Systems analysis in education	1
		2.3	Pedagogical psychology and communication	1
		2.4	Interaction with stakeholders	1
		2.5	Sustainable development	1
iPET-3	**A**		1.1, 1.2,1,3	2

(20 ECTU)	**B**		2.1, 2.2, 2.3, 2.4, 2.5	6
	C	3.1	Digital education	2
		3.2	Problem-based, Project-based and practice-oriented learning	2
		3.3	Learning outcomes' assessment	2
		3.4	Course design	1
		3.5	Engineering innovation process	2
		3.6	Final project	3

The second task of the WP2 was to develop syllabuses for each of the iPET courses. Each syllabus has been developed by a team of 3 consortium partners, with one leading partner and 2 co-authoring partners. Then, all syllabuses have been reviewed by each partner university of the ENTER project consortium. During an online meeting of ENTER project members in Bratislava, Slovakia, on April 21-23, 2020, all syllabuses and review notes have been presented, discussed and adjusted accordingly, leading to the creation of three deliverables presenting syllabuses (draft v.1) for iPET-1, iPET-2 and iPET-3.

The syllabuses for iPET-2 courses are presented in the following document.

SYLLABUS FOR COURSE 2.1. ENHANCEMENT OF LEARNING INTERACTIVITY

INSTITUTION:	**TO BE FILLED LATER**
PROGRAM:	**iPET 2**
COURSE:	**2.1 - ENHANCEMENT OF LEARNING INTERACTIVITY**

I – IDENTIFICATION						
COMPULSORY COURSE	**CONTACT TIME - HOURS**				**SELF-STUDY - HOURS**	**CREDITS ECTS**
	LECTURES	**TUTORIALS**	**PRACTICAL /PROJECT**	**TOTAL**		
ENHANCEMENT OF LEARNING INTERACTIVITY	**10**	**5**	**16**	**50**	**19**	**2**

FORMAL PREREQUISITES (IF ANY): iPET-1 COURSES
COURSE WEBSITE URL: TO BE FILLED LATER

II – AIMS, SYNOPSIS, CHARACTERIZATION

Background (max. 600 characters)
Interactive teaching assumes active involvement of learners in the learning process by regular teacher-learner and learner-learner interaction, use of audio-visuals, contemporary technology and hands-on learning. Interactive methods encourage the interest in the profession; promote efficient acquisition of learning materials; provide high motivation, knowledge, team spirit and freedom of expression; and most importantly, contribute to the complex competences of future engineering specialists. Intense and diversified academic and professional interactions can stimulate the learners' active, reflective, integrative, and collaborative engagements at deeper levels.

Aims – overview (max. 750 characters)
The course supports engineering educators' ability to develop, adapt and implement innovative interactive teaching and learning methods and technologies (inter alia, aimed at increasing learners' motivation and supporting learning with deep understanding). The course supports engineering educators in creation of an adequate and positive, supportive and contemporary physical and virtual learning environment and in the process of selection of suitable teaching technologies supporting interactive learning, thus integrating the most effective innovative educational technologies with contemporary teaching methods.

Specific Aims (max. 1000 characters)

- O1. To master the main contemporary teaching technologies to back up innovative and motivating teaching;
- O2. To implement innovative technologies in the active process of teaching and learning;
- O3. To integrate the most effective innovative educational technologies with suitable interactive teaching methods;
- O4 To analyze and select suitable interactive teaching and learning methods for motivating and deep learning;
- O5. To evaluate the role and use suitable multimedia technologies in the process of teaching and learning.

Contents (max. 1000 characters)

- The most important contemporary teaching and learning technologies, technical devices, equipment and systems, their function, operation and wise use to back up effective and innovative teaching. The choice of suitable teaching technologies.
- Lecture (lecture – dialogue – interactive lecture).
- Briefing. Webinar. Video Conference Video lecture. Virtual consultation. Virtual tutorial. Online workshops.
- Educational games and simulations.
- Methods, models, techniques and strategies of effective teaching supported by innovative technologies, facilitating the increase of learners' activity and interaction. Active learning methods for interactive learning (Recall-summarize, question-connect-comment; One-minute paper; Muddiest point; Problem/dilemma posing; Problem-based learning, Inquiry-based learning; Case-based learning; Seed-Evolve-Reseed-Outcome; Think-Pair-Share; Flipped Classroom, brainstorming, out-of-class interactions, Learning Management Systems, Online communities, Facebook groups, Whatsapp groups, etc.
- Team-based learning and group work.

Main Teaching Material

1. Felder Richard M., Brent Rebecca (2016). Teaching and Learning STEM – A Practical Guide. Jossey-Bass, A Wiley Brand.
2. Wankat P.C., Oreovicz F.S. (2015). Teaching Engineering. Purdue University Press; 2 edition
3. Peter Goodhew (2010) Teaching Engineering Kindle Edition
4. Miyased T.A. Interactive learning technologies. Workshop for teachers. M., 2004. – 185 p.

Complementary Teaching Material

1. https://goelsan.wordpress.com/2011/04/29/sero-model-for-inquiry-teaching-in-software-development-education/
2. Eric Mazur, Physics, Harvard: https://www.youtube.com/watch?v=wont2v_LZ1E
3. Richard Felder, Chem Engg. UNC: https://www.youtube.com/watch?v=1J1URbdisYE

Teaching/Learning Tools

Classroom tools. Communication and Organisation. Design. Flashcards. Forums. Games. Instructionals. Learning. Simulations. Learning Management System. Massive Open Online Courses. Organisation. Programming. Mindfulness. General Tools for Teachers. Tools for Teaching Medicine. Video Lessons. Quiz / Assessment Tools. E-portfolio environment (padlet, Google, Brightspace, FolioSpaces etc).

- Socrative - https://socrative.com/
- Classtime - https://www.classtime.com/en/
- Kahoot! - https://create.kahoot.it/login
- Quizizz – https://quizizz.com/
- Poll Everywhere - https://www.polleverywhere.com/
- Quizzwhizzer - https://quizwhizzer.com/
- Answer Garden - https://answergarden.ch/
- Triventy - http://www.triventy.com/
- Quizlet - https://quizlet.com/
- Plickers – https://get.plickers.com/
- Mentimeter - https://www.mentimeter.com
- Padlet - https://padlet.com/
- Tricider - https://www.tricider.com

- Stormboard - https://stormboard.com/
- Etc.

Previous knowledge assumed as acquired

Material	Source
-	-

Teaching/Learning methodology

Describe innovative teaching and learning methods

Active and interactive learning methods. Some examples could be found under the link: https://www.uky.edu/celt/50-classroom-assessment-techniques-cats

Characterization of objectives and course program

A – Estimated percentage distribution of pedagogical and technological content

- Pedagogical component (establishes and develops pedagogical basis) – 50 %
- Technological component (applies to design and process operation) – 50 %

Characterization of objectives and course program

B – Outcomes – in conformity with EUR-ACE criteria (later on we will adjust this to the ENTER Standards)

Group of outcomes	Outcome
Knowledge and Understanding	O1. To master the main contemporary teaching technologies to back up innovative and motivating teaching;
Organization of students' Engineering Analysis	O4. To analyse and select suitable interactive teaching and learning methods for motivating and deep learning; O5. To evaluate the role and use suitable multimedia technologies in the process of teaching and learning.
Organization of students' Engineering Design	O3. To integrate the most effective innovative educational technologies with suitable interactive teaching methods;
Organization of students' Investigations	
Organization of students' Engineering Practice	O2. To implement innovative technologies in the active process of teaching and learning;
Transferable Skills	O4. To analyse and select suitable interactive teaching and learning methods for motivating and deep learning; O5. To evaluate the role and use suitable multimedia technologies in the process of teaching and learning.

III – PLANNING

COMPULSORY UNITS of the Course (including self-guided learning)	SUMMARY	OBSERVATIONS

The most important contemporary teaching and learning technologies	Technical devices, equipment and systems, their function, operation and wise use to back up effective and innovative teaching. The main effective presentation techniques.	Interaction of teachers and participants, group work, active learning Interactive lecture (4 hrs), practice (4 hrs), self-study hours (3 hrs) O1, O2 *Estimated time presented, as active learning is used, the time may be changed in all units*
Media in teaching engineering.	The choice of suitable teaching technologies. Briefing. Webinar. Video conference video lecture. Virtual consultation. Virtual tutorial. Online workshops. E-learning courses, virtual environments and techniques. Binary lecture (lecture – dialogue – interactive lecture). Group discussion (discussion in an undertone). Debate. Educational games and simulations.	Interaction of teachers and participants, group work, active learning Interactive lecture (4 hrs), Practice (4 hrs), self-study hours (3 hrs) O2, O3
Methods, models and strategies of effective teaching engineering supported by innovative technologies.	Active learning methods for interactive learning: recall-summarize, question-connect-comment; one-minute paper; muddiest point; problem/dilemma posing; problem-based learning, inquiry-based learning; case-based learning; seed-evolve-reseed-outcome; think-pair-share; flipped classroom, brainstorming, out-of-class interactions, learning management systems, online communities, Facebook groups, WhatsApp groups, etc.	Interactive group work, active learning, interaction of learners, practical exercises. Lecture (2 hrs), Tutorial (3 hrs), Practice (4 hrs), self-study (3 hrs) O1, O2, O3, O4
Active learning.	Team-based learning and group work.	Group exercises, active learning methods Tutorial (2 hrs), Practice (2 hrs), self-study (3 hrs) O4, O5
How to develop online workshop and tutorials	Online workshop	Development of a workshop, Practice (3 hrs), self-study (3 hrs) O2, O3, O4, O5
Final presentations of course portfolios	Presentations	Practice (2 hrs), self-study (4 hrs) O1, O2, O3, O4, O5

IV – ASSESSMENT PROCEDURE

Self-Assessment Self-analysis of one's course design, analysis of the designed learning outcomes and the process of learning and teaching, reflections on teaching presented in the course portfolio. Pencil & paper, *Catme* freeware, E-portfolio environments (padlet, Google etc).
Peer-Assessment (formative), feedback in tutorials and practical exercises, in group work and presentations. Feedback, Catme freeware
Teacher´s Assessment Pass/fail assessment at the end of the course (summative) on the basis of the whole learning process. Formative assessment (feedback) during active learning, group work and team-based learning. Self-assessment (40%), peer-assessment (40%), Summative assessment (20%)

ASSESSMENT TOOL 1

NAME	Self-assessment (course portfolio)
TOOL TYPE	Self-analysis, reflection and metacognition. Reflection models (Korthage, Gibbs, onion model, mentoring model etc).
ASSESSMENT TYPE	Formative
IMPLEMENTATION	Pencil & paper, *Catme* freeware, course portfolio
DESCRIPTION	Self-analysis of one's course design, analysis of the designed learning outcomes and the process of learning and teaching, reflections on teaching presented in the course portfolio.
CRITERIA, RUBRICS, RATING SCALES	for self-improvement

ASSESSMENT TOOL 2

NAME	Peer-assessment
TOOL TYPE	Feedback
ASSESSMENT TYPE	Formative
IMPLEMENTATION	Group work, Catme freeware, course portfolio
DESCRIPTION	feedback at tutorials and practical exercises, in group work and presentations.
CRITERIA, RUBRICS, RATING SCALES	For self-improvement and improvement of the quality of teaching

ASSESSMENT TOOL 3

NAME	Feedback
TOOL TYPE	Teacher's assessment
ASSESSMENT TYPE	Formative
IMPLEMENTATION	Feedback on group work, Catme freeware, paper & pencil
DESCRIPTION	Formative assessment (feedback) during active learning, group work and team-based learning.
CRITERIA, RUBRICS, RATING SCALES	For self-improvement

ASSESSMENT TOOL 4

NAME	Pass/fail assessment (final)
TOOL TYPE	Teacher's assessment
ASSESSMENT TYPE	Summative
IMPLEMENTATION	Presentation of a course portfolio and fulfilling all requirements of group works and self-study analysis
DESCRIPTION	Pass/fail assessment at the end of the course (summative) on the basis of the whole learning process.
CRITERIA, RUBRICS, RATING SCALES	For improvement of teaching quality

ASSESSMENT TOOLS VERSUS OUTCOMES

TOOLS / OUTCOMES	TOOL 1 SELF-ASSESSMENT	TOOL 2 PEER-ASSESSMENT	TOOL 3 TEACHER FEEDBACK	TOOL 4 TEACHER ASSESSMENT
O1	X	X	X	X
O2	X	X	X	X
O3	X	X	X	X
O4	X	X	X	X
O5	X	X	X	X

ASSESSMENT: ACHIEVED LEVEL OF LEARNING OUTCOMES (TO BE FILLED DURING OR AT THE END OF THE COURSE)

OUTCOME	NOT IMPLEMENTED	ATTEMPTED IMPLEMENTATION	MANY DEFECTS	SOME DEFECTS	MINOR DEFECTS	CORRECT	EXCEPTIONAL
OUTCOME 1							
OUTCOME 2							
…							
OUTCOME N							

Levels of outcomes' achievement correspond to:

- **Exceptional** - exceeded all goals; applied knowledge to new situations and / or solved standard problems competently
- **Correct** - achieved all objectives in a minimally competent manner; applied the knowledge and skills to known standard cases
- **Minor defects** - achieved the most important goals competently; denoted some shortcomings
- **Some defects** - reached the objectives in general computation; demonstrated some weaknesses/defects
- **Many defects** - achieved only minimum goals; demonstrated many weaknesses/defects
- **Attempted Implementation** - failed to meet minimum objectives; demonstrated some skills
- **Not Implemented** - have not demonstrated a minimally significant set of skills; violated fundamental principles of engineering science / pedagogy and / or nothing minimally acceptable was produced

NOTES (PRIVATE/RESTRICTED TO THIS FORM)

NOTES (PUBLIC/TO BE AVAILABLE ONLINE)

SYLLABUS FOR COURSE 2.2. SYSTEMS ANALYSIS IN EDUCATION

INSTITUTION:	**TO BE FILLED LATER**
PROGRAM:	**iPET 2**
COURSE:	**2.2. SYSTEMS ANALYSIS IN EDUCATION**

	I – IDENTIFICATION					
COMPULSORY COURSE	**CONTACT TIME - HOURS**				**SELF-STUDY - HOURS**	**CREDITS ECTS**
	LECTURES	**TUTORIALS**	**PRACTICAL /PROJECT**	**TOTAL**		
SYSTEMS ANALYSIS IN EDUCATION	**6**	**6**	**6**	**18**	**7**	**1**

	FORMAL PREREQUISITES (IF ANY): -
	COURSE WEBSITE URL: TO BE FILLED LATER

II – AIMS, SYNOPSIS, CHARACTERIZATION

Background (max. 600 characters)

Modern trends in economic, industrial and educational development in the world are characterized by the growing need for specialists capable of system thinking, analysis and synthesis of complex systems, their mathematical, information and software. The combination of this knowledge will allow to understand, study and improve any system, product or process. Proper understanding of a problem and how different elements influence each other is important for any field of engineering. It is therefore important to teach different methods to analyse any system and improve its components.

Aims – overview (max. 750 characters)

The discipline creates a basis for the logical and consistent approach to the problem of how to make decisions, allows educators to obtain the necessary theoretical knowledge and practical experience to develop new and improve existing methods and tools for analysis of information processing and management of complex systems, improve the reliability and quality of various systems.

The main goal is to give teachers the opportunity to teach how to use any system, product or process and divide them into components. Then analyse the components and find alternative solutions, choose the right solution. This is designed to improve the system under analysis. Or suggesting an alternative solution for the system or fixing a problem that has arisen in the system.

The approach can be in different areas because basically any engineering discipline has systems, product or processes.

Specific Aims (max. 1000 characters)

1. To teach a set of methods to study complex systems: technical, economic, environmental, etc.(O1).
2. To define system links and regularities of functioning and development of objects and processes taking into account industry specifics, improving their management efficiency (O2).

3. To describe the qualitative characteristics of the pedagogical system: its integrity, structure, interdependence of the system and environment, hierarchy, plurality of descriptions of each system and so on (O3) .

4. To divide systems, products or processes into small components that include only one function. Analyse the function or purpose of each component. Find other suitable alternative solutions (O4) .

5. To find correlation between components, type of connection, determine the impact of changing one component on the other, determine the sequence of tasks, improve examination and evaluation system, maintain, control and improve the guidance services (O4, O5) .

6. To find new solutions that can improve or restructure the system / product / process. Search for different solution directions. Create many suitable alternatives and choose among them. Apply multipurpose decision making process and identify the method how to make this decision (O6).

Contents (max. 1000 characters)

1. Theoretical and applied questions of system communications and regularities of functioning and development of objects and processes taking into account branch features, increase of efficiency of their management with use of modern methods of information processing. This part of the course is 30% of the total volume.

2. Theoretical bases and methods of system analysis, optimization, management, decision making and information processing; methods and algorithms of identification of control systems; methods and algorithms of structural-parametric synthesis and identification of complex systems; development of problem-oriented systems of management, decision making and optimization of various objects. This part of the course is 30% of the total volume

3. Methods and algorithms of management decision making, forecasting and evaluation of efficiency, quality and reliability of complex systems; visualization, transformation and analysis of information based on computer information processing methods; methods for obtaining, analyzing and processing expert information. This part of the course is 40% of the total volume

The theoretical part of the course is to give an overview on how to analyse any system, how to determine its parts, their function or purpose, how to identify the connections and correlation between the parts and finally, how to find different solutions and select the most suitable one to these parts.
For each step of the theory there are practical classes on implementation of the method/theory in education, industry, when solving engineering problems, development of a specific product, software, etc. At practical lessons educators apply the acquired knowledge for individual or group decision of relatively simple problem.

Main Teaching Material

1. Joseph O'Connor, Ian McDermott. The Art of Systems Thinking - Essential Skills for Creativity and Problem Solving. ISBN: 978-0722534427, Publishing House: Thorsons, 1997. HarperCollins Publishers Ltd, -288 p. (English).
2. Donella H. Meadows. Thinking in Systems: A Primer. ISBN: 1603580557 (ISBN13: 9781603580557), Publisher: Chelsea Green Publishing (December 3, 2008), 240 p. (English).
3. Tarasenko F.P. Applied system analysis. ISBN - 0367515334, ISBN-13(EAN): 9780367515331, Publisher: Taylor & Francis Group, 2020, - 304 p. (English)

Complementary Teaching Material

1. Alexeyeva MB, Vetrenko P. P.- SYSTEMS THEORY AND SYSTEM ANALYSIS. Textbook and Workshop for Academic Bachelor-M.: Yureit Publishing House, 2019-304-Bachelor. Academic Course-978-5-534-00636-0: - Electronic Text // EBS Yureit - https://biblio-online.ru/book/teoriya-sistem-i-sistemnyy-analiz-433246.

2. Systems theory and system analysis : tutorial / A.M. Korikov; S.N. Pavlov. - M. : INFRA-M, 2017. - 288 c. - (Higher education: Bachelor's degree). - www.dx.doi.org/10.12737/904. - Access mode: http://znanium.com/catalog/product/752468.
3. Systems theory and system analysis : tutorial / A.M. Korikov; S.N. Pavlov. - M. : INFRA-M, 2018. - 288 p. - (Higher education: Bachelor's degree). - www.dx.doi.org/10.12737/904. - Access mode: http://znanium.com/catalog/product/935445.
4. Systems theory and system analysis : tutorial / A.M. Korikov; S.N. Pavlov. - M. : INFRA-M, 2019. - 288 p. - (Higher education: Bachelor's degree). - www.dx.doi.org/10.12737/904. - Access mode: http://znanium.com/catalog/product/994445.
5. Systems theory and system analysis (in Russian) / Vdovin, V.M.; Surkova, L.E.; Valentinov, V.A. - 3rd edition. - M.: Dashkov and K, 2018. - 644 p.: ISBN 978-5-394-02139-8 - Access mode: http://znanium.com/catalog/product/415155.
6. Chapters 6 Concept generation and Chapter 7 Concept selection. Ulrich, K.T., Eppinger, S.D., Product Design and Development, McGraw-Hill, 2012.

Teaching/LearningTools

MS Excel, Word, Moodle: overview/summary as video lectures, self-reflection test, presentation materials, open statistical databases, methodical recommendations for carrying out practical tasks, analytical materials in the field of education and engineering

Previous knowledge assumed as acquired

Material	Source
—	—

Teaching/Learning methodology

The course will use traditional methods: verbal (lecture, etc.); visual (show, demonstration, etc.); practical methods (work on the project, etc.).
By the character of mutual activity of the teacher and educators - the system will be used explanatory and illustrative method, method of problem presentation, partial search method.
According to the main components of the teacher's activity, the following methods will be used: a) methods of organization and implementation of learning activities (verbal, visual, practical, problematic, independent work and work under the guidance of the teacher); b) methods of stimulation and motivation; c) methods of control and self-control (written control, practical work, test control, current and final control).

Characterization of objectives and course program
A – Estimated percentage distribution of pedagogical and technological content

- Pedagogical component 50 %
- Technological component 50 %

These percentages are not fixed and can be change according to the system being analysed and the background of the educators taking the course.

Characterization of objectives and course program
B – Outcomes – in conformity with EUR-ACE criteria (later on we will adjust this to the ENTER Standards)

Group of outcomes	Outcome
Knowledge and Understanding	**OUTCOME** 1 - To identify a method that enables to analyse tools, solutions, products used in their respective fields on a system level and make improvements accordingly. To distinguish concept development and selection for different problems/parts of the system.
Organization of students' Engineering Analysis	**OUTCOME** 2 - To analyse products, systems and solutions. To specify the exact function and purpose of products, systems and processes. To evaluate proposed solutions.
Organization of students' Engineering Design	**OUTCOME** 3 - To create different and innovative concepts. To apply methods all of the solution options.
Organization of students' Investigations	**OUTCOME 4 -** To research technical issue in target field based on functionality, rather than specific physical solutions.
Organization of students' Engineering Practice	**OUTCOME** 5 - To apply learned method to practical problems of the field or of student's own personal experience/need.
Transferable Skills	**OUTCOME 6 -** TO apply the learned methods to problem solving, product development, software/service development, engineering and design, decision making in multiple objective problems.

III – PLANNING

COMPULSORY UNITS of the Course **(including self-guided learning)**	**SUMMARY**	**OBSERVATIONS**
Basic concepts of systems theory	Complex systems. Feedback principle. Self-organization in complex systems.	Lectures - 1 Tutorials - 1 Outcome 1
System resources of society. The role of system approach in education.	Features of socio-economic systems. Structural components of pedagogical system.	Practical/Project - 1 Self-Study-Hours - 1 Outcomes 1, 2
Methodology of analysis of systems with different structure	Methods of qualitative evaluation of systems. Identification of objectives. Formation of criteria. Generation of alternatives. Factor analysis.	Lectures - 1 Tutorials - 1 Self-Study-Hours - 1 Outcomes 2, 3, 4
Principles and regularities of systems research and modeling	Tasks, models and methods of multivariate statistical analysis and directions of its practical application in system analysis.	Lectures - 1 Practical/Project - 1 Self-Study-Hours-1 Outcomes 1, 2, 3, 4, 5
Logic and Methodology of System Analysis	Systemic consideration of the object. Subprocesses of	Lectures - 1 Tutorials - 1

	functioning system: basic process, feedback and limitation.	Self-Study-Hours-1 Outcomes 2, 3, 5
Functional, morphological (structural) and information description and modelling of systems	Sophisticated systems. Subsystems and their interconnections. Leading subsystems. Composite properties of the system.	Lectures - 1 Practical/Project - 2 Self-Study-Hours-1 Outcomes 2, 3, 5
System performance indicators and criteria	Indicators of the quality of the operation. Efficiency.	Tutorials - 1 Self-Study-Hours-1 Outcomes 2, 3, 5, 6
Game theory and decision making	Decision-making methods and procedures. Operation of choice of the decision. Selection of the main criterion.	Tutorials – 2 Self-Study-Hours-1 Outcomes 2, 3, 5, 6
Theory and practice of system analysis implementation	Principle and object of evaluation and management. Organizational structures of management.	Lectures - 1 Practical/Project - 2 Outcomes 5, 6

IV – ASSESSMENT PROCEDURE

Self-Assessment

The self-assessment will be carried out by the trainees before starting the project. This will allow educators to determine whether they are ready to start working on a project, whether they are ready for group work on a project. During the project, the self-assessment will allow each educator to determine their level of project work, the correctness of the work, and the autonomy of their actions. Self-assessment of educators when working in a group allows them to identify their role in the group and their ability to cooperate in the group. Self-assessment of educators after working on a project will allow them to analyse their activities. At the same time, the educator can make comments on the work process. It is also possible for educators to mutually evaluate themselves.
One option would be that everybody has to evaluate and give feedback to one of their course mates.

Teacher´s Assessment

A teacher evaluates the involvement of educators in the process of self-learning and its application (motivation, reflexion, ability to make choices, plan, analyse, and evaluate the results of their own activities), how well the system/product is analysed, how the method has been implemented and how reasonable and realistic are the results. Teacher assesses these three criteria and also reads the feed-back given to that student’s work and how that s educator gave feedback to other course mate.
The teacher spends:
- entrance control in the form of testing at the beginning of training to determine whether the competencies available to trainees meet the established requirements (10% of the final grade);
- ongoing control in the form of individual practical tasks or group discussions (30% of the final grade);
- intermediate control in the form of testing for each discipline section (20% of the final grade);

- final control in the form of project protection (40% of the final grade).

ASSESSMENT TOOLS (ONE TABLE FOR EACH TOOL)

ASSESSMENT TOOL 1

NAME	**TOOL 1**
TOOL TYPE	Entrance test
ASSESSMENT TYPE	Diagnostic
IMPLEMENTATION	Performed using information technology
DESCRIPTION	Includes 10 closed questions
CRITERIA, RUBRICS, RATING SCALES	At least 70% of the correct answers

ASSESSMENT TOOL 2

NAME	**TOOL 2**
TOOL TYPE	Group practical tasks
ASSESSMENT TYPE	Forming
IMPLEMENTATION	Practical tasks performed by listeners
DESCRIPTION	Educators submit an group task and checks with the teacher whether there are all the necessary chapters, how well the method is implemented and how realistic/reasonable the results presented are.
CRITERIA, RUBRICS, RATING SCALES	The evaluation consists of three parts: system / product analysis, method application, results and conclusions. All three make up 33% of the final evaluation (or decision to pass / fail).

ASSESSMENT TOOL 3

NAME	**TOOL 3**
TOOL TYPE	Group discussion
ASSESSMENT TYPE	Forming
IMPLEMENTATION	During 15 minutes the problem situation is discussed, the listeners give their opinion
DESCRIPTION	Analysing the problem situation, determining the causes and finding solutions
CRITERIA, RUBRICS, RATING SCALES	Evaluated: - Argumentativeness of the answer; - specificity of proposals; - relying on experience; - feasibility of the proposed solutions.

ASSESSMENT TOOL 4

NAME	**TOOL 4**
TOOL TYPE	Test
ASSESSMENT TYPE	Summing up
IMPLEMENTATION	Performed using information technology

DESCRIPTION	Includes 10 closed questions for each discipline section. It is held after each section of the discipline.
CRITERIA, RUBRICS, RATING SCALES	At least 75% of correct answers

ASSESSMENT TOOL 5

NAME	**TOOL 5**
TOOL TYPE	Project
ASSESSMENT TYPE	Summing up
IMPLEMENTATION	Group project activities
DESCRIPTION	
CRITERIA, RUBRICS, RATING SCALES	Evaluated: - Argumentativeness of proposals; - specificity of proposals; - reliance on existing experience; - feasibility of the proposed solutions.

ASSESSMENT TOOLS VERSUS OUTCOMES

TOOLS / OUTCOMES	TOOL 1	TOOL 2	TOOL 3	TOOL 4	TOOL 5
OUTCOME 1	x		x	x	x
OUTCOME 2		x	x		x
OUTCOME 3		x	x		x
OUTCOME 4		x	x		x
OUTCOME 5		x			x
OUTCOME 6		x			x

ASSESSMENT: ACHIEVED LEVEL OF LEARNING OUTCOMES (TO BE FILLED DURING OR AT THE END OF THE COURSE)

OUTCOME	NOT IMPLEMENTED	ATTEMPTED IMPLEMENTATION	MANY DEFECTS	SOME DEFECTS	MINOR DEFECTS	CORRECT	EXCEPTIONAL
OUTCOME 1							
OUTCOME 2							
…							
OUTCOME N							

Levels of outcomes' achievement correspond to:

- **Exceptional** - exceeded all goals; applied knowledge to new situations and / or solved standard problems competently
- **Correct** - achieved all objectives in a minimally competent manner; applied the knowledge and skills to known standard cases
- **Minor defects** - achieved the most important goals competently; denoted some shortcomings

- **Some defects** - reached the objectives in general computation; demonstrated some weaknesses/defects
- **Many defects** - achieved only minimum goals; demonstrated many weaknesses/defects
- **Attempted Implementation** - failed to meet minimum objectives; demonstrated some skills
- **Not Implemented** - have not demonstrated a minimally significant set of skills; violated fundamental principles of engineering science / pedagogy and / or nothing minimally acceptable was produced

NOTES (PRIVATE/RESTRICTED TO THIS FORM)

NOTES (PUBLIC/TO BE AVAILABLE ONLINE)

SYLLABUS FOR COURSE 2.3. PEDAGOGICAL PSYCHOLOGY AND COMMUNICATION

INSTITUTION:	**TO BE FILLED LATER**
PROGRAM:	**IPET 2**
COURSE:	**2.3. PEDAGOGICAL PSYCHOLOGY AND COMMUNICATION**

I – IDENTIFICATION

COMPULSORY Course	CONTACT TIME - HOURS				SELF-STUDY - HOURS	CREDITS ECTS
	LECTURES	TUTORIALS	PRACTICAL /PROJECT	TOTAL		
PEDAGOGICAL PSYCHOLOGY AND COMMUNICATION	12	1	6	25	6	1

FORMAL PREREQUISITES (IF ANY):

COURSE WEBSITE URL: TO BE FILLED LATER

II – AIMS, SYNOPSIS, CHARACTERIZATION

Background (max. 600 characters)

Pedagogical psychology is one of the most important branches of psychological science. In the structure of the professional competence of teachers of high school psycho-pedagogical competences are recognized as its integral part. The need to intensify the educational process and the formation of abilities of competitive specialists cause increased requirements to the level of creative and pedagogical competencies of engineering educators. That's why the study of psychology of student personality development and methods of training and education that increase the effectiveness of educational tasks are necessary for engineering educators.

Aims – overview (max. 750 characters)

The discipline is aimed at preparing the teacher for the organization of educational training by means of engineering disciplines, at formation of skills to assist students in choosing targets in the profession and life.

To form universal psycho-pedagogical competencies that provide effective solution to a wide range of social personal and professional tasks in any profession:

• interpersonal communication competence;
• social problems solving in the team competence;
• team management competence;
• lifelong learning and professional self-improvement competence;
• family life competence".

The discipline is a system-forming component in the process of improving pedagogical skills of the engineering educator.

Specific Aims (max. 1000 characters)

1. O1. To define requirements for psychological and pedagogical readiness of a higher school educator.
2. O2. To recognize psychology of personal development and psychological and pedagogical foundations of education.

3. O3. To explore the creative potential of students and the mechanisms of creative cognitive processes.
4. O4. To carry out pedagogical research and develop innovative educational technologies.
5. O5. To organize the spiritual and moral development of students and their definition of value orientations of their professional development.
6. O6. To build a personal educational track and organize self-development.
7. O7. To implement methodological and organizational support of creative development of students in the development of engineering specialties.
8. O8. To use the potential of digitalization to improve the quality of engineering education.
9. O9. To cultivate students' skills of self-analysis, psychological understanding self-knowledge and self-realization, skills of systemic and comparative analysis, critical thinking and self-reflection

Contents (max. 1000 characters)

In the process of development of the course the following modules are mastered:

- Psychological and pedagogical readiness of a higher school teacher. Psychology and pedagogy in the professional activity of a University teacher.
- Psychology of personality development in engineering psychology. Innate and acquired qualities in the individual. Regularities of sustainable personal and professional development.
- Psychological and pedagogical bases of education. Psychological and pedagogical factors in educational process.
- Axiology of engineering education. Fundamentals of modern axiology, categories of spirituality, morality, civil responsibility and legal consciousness. Mechanisms of formation of spirituality and moral guidelines of students.
- Pedagogical communication. Styles of pedagogical communication. Speech behavior and the basics of nonverbal communication. Barriers to effective communication and ways to overcome them.
- Psychology of creativity. Algorithms for solving non-standard problems. Management of creative activity. Organization of innovative activity at the enterprise.
- Digitalization of education. Models of training and education in digital space.
- Pedagogical innovation in education. Innovative methods of training and education that improve the quality of education.
- Methodology of professional development of a teacher-researcher.
- Psychological and pedagogical bases of organization of students' creative development. Reflection of activity and design of a personal educational track. Activities of the tutor.

Main Teaching Material

1. M.I. Grishkova. Pedagogics of Higher School [Electronic resource]: UNITY-DANA, 2015. – 447 p. — Access regime: http://www.iprbookshop.ru/52045.html
2. I.D. Afonin. Psychology and Pedagogics of Higher School [Electronic resource]: Rusains, 2016. – 248 p. – Access regime: http://www.iprbookshop.ru/61648.html
3. F.V. Sharipov Pedagogics and Psychology of Higher School [Electronic resource] : Logos, 2012. – 448 p. – Access regime: http://www.iprbookshop.ru/9147.html

technical university. – Tambov: TSTU publ., 2019. – 96 p.

5. N.V. Molotkova. Pedagogical support of creative self-development of the student in conditions of education digitalization– Tambov: TSTU publ., 2019. – 80 p.
6. A.I. Popov Pedagogic Scientific Research of Post Graduate Students– Tambov: TSTU publ., 2017. – 80 p.
7. A.I. Popov Algorithms of Non-standard Problems Solution– Tambov: TSTU publ., 2019. – 80 p.

Complementary Teaching Material

1. V.I. Blinov. Methods of teaching in higher education: Yurait, 2014. - 315 p.
2. A.I. Popov. Innovative educational technologies for creative development of students. Pedagogical practice. – Tambov: TSTU publ., 2013. – 80 p.
3. E.I. Muratova. Organization of pedagogical practice of postgraduates. – Tambov: TSTU publ., 2017. – 80 p.
4. A.I. Popov. The content and organization of educational activities of students in the development of competence-oriented educational program of HPE in accordance with the requirements of the Federal state educational standard - TSTU publ., 2012. – 32 p.
5. N.P. Puchkov. Olympiad movement as a form of education organization in higher education. – Tambov: TSTU publ., 2009. – 180 p.
6. B.R. Mandel. Pedagogies [Electronic resource]. – FLINTA, 2014. – 288 p. – Access regime: https://e.lanbook.com/book/63010.
7. A.A. Naumov. History and philosophy of special pedagogy and psychology [Electronic resource]: Course of lectures. – Perm, PGGPU, 2014. – 100 p. – Access regime: http://www.iprbookshop.ru/32046.html
8. V.A. Kruchinin. Psychology and pedagogy of higher education. Part I [Electronic resource]: – N. Novgorod: NNGASU, ACB, 2013. – 197 p. – Access regime: http://www.iprbookshop.ru/20793.html
9. V.A. Kruchinin. Psychology and pedagogy of higher education. Part II [Electronic resource]: – N. Novgorod: NNGASU, ACB, 2014. – 195 p. – Access regime: http://www.iprbookshop.ru/54959.html
10. F.V. Uzunov. Modern educational technologies [Electronic resource]– Simferopol: University of Economics and Management, 2016. – 113 p. – Access regime: http://www.iprbookshop.ru/54717.html
11. Journal «Educational Technologies» Access regime: https://elibrary.ru/
12. Journal «Higher Education Today» Access regime: https://elibrary.ru/
13. Journal «Issues of Contemporary Science and Practice. V.I. Vernadsky University» Access regime: https://elibrary.ru/, http://vernadsky.tstu.ru/ru
14. E-journal «Higher Education in Russia» Access regime: https://elibrary.ru/
15. E-journal «Almamater. Bulletin of Higher School» Access regime: https://elibrary.ru/
16. N.S. Belousova. Labor psychology, engineering psychology and ergonomics. [Electronic resource]- Ural State Pedagogical Institute, 2017. Access regime: http://elar.uspu.ru/bitstream/uspu/6421/1/uch00182.pdf

Teaching/Learning Tools

1. National online learning portal “Open Education” https://openedu.ru
2. Software MSOffice, Windows, tools of teleconferencing
3. System of distant learning VitaLMS

Previous knowledge assumed as acquired

Material	Source
knowledge of ethics features of mutual relations of educational activity subjects	Pedagogics of higher education
knowledge of laws and other normative legal acts on higher education, educational and professional standards of higher education in the field of training (specialty) (if available)	
knowledge of general bases of pedagogy and psychology, didactics of higher education, trends in the development of pedagogical science	
proficiency in analysing information sources on problems of pedagogy and psychology	
knowledge of laws of innovative development, technological structures and the role of engineering in innovative transformation, the role of creativity in the successful professional implementation of the engineer	Management of innovative activity
knowledge of methods for overcoming psychological inertia and ways to solve inventive problems	

Teaching/Learning methodology

Training is organized on the basis of the following methods:

- practice (activity),
- research,
- problem-based learning,
- case study,
- e-learning.

The following educational technologies are used: problem-based learning technology, project-based learning technology, contextual learning technology, advanced learning technology, developmental learning technology, digital educational technologies, psychological coaching.

Characterization of objectives and course program

A – Estimated percentage distribution of pedagogical and technological content

- Pedagogical component (establishes and develops knowledge of pedagogy bases)– 65 %
- Technology component (for process development and management) – 35 %

Characterization of objectives and course program

B – Outcomes – in conformity with EUR-ACE criteria (later on we will adjust this to the ENTER Standards)

Group of outcomes	Outcome
Knowledge and understanding	O1
	O2
Organization of students' Investigations	O3
	O4
Transferable Skills	O5
	O6
	O7
	O8
	O9

III – PLANNING		
COMPULSORY UNITS of the Course	**SUMMARY**	**OBSERVATIONS**
Psychological and pedagogical readiness of the higher school teacher	Sustainable psychological and pedagogical readiness of a higher school teacher. General psychological preparedness. Professional and psychological training. Psychology and pedagogy in the professional activity of a university teacher. Professional qualifications of the teacher.	
Psychology of personality development	Psychology of personality development. Personality as an object and subject of pedagogy. Biological and social development of the human personality and the formation of his personality. The driving forces and the basic laws of personal development. Factors affecting the formation of personality. Peculiarities of development and typology of the student's personality. The main psychological regularities of individual development. Integrity of the person and his behaviour. Personality, behaviour, and external conditions. The influence of individual psychological characteristics of a person on the efficiency, reliability and safety of work	
Psychological and pedagogical bases of education	Psychological and pedagogical bases of education. Behaviourism theory and cognitive development. Professional preparedness and education. The system of professional education. The essence of pedagogical activities of educational institutions. Psychological and pedagogical factors in educational process. Perception process of infographics and videos. Formation of personality in educational process. Motivation of professional self-development.	
Axiology of engineering education	Value orientations of modern youth. Spirituality, morality and civic consciousness as the basis of an engineer's readiness for innovation. Mechanisms of formation of spirituality and moral guidelines based on traditions of engineering education and regional economy. Development of the project "Contribution of university scientists to the development of science, engineering and technology" (creation of electronic popular scientific educational resource)	
Psychology of creativity. Management of creative activity.	Fundamentals of innovation. Psychology of creativity. Emotional and cognitive intellect in finding new solutions. Algorithms for solving non-standard problems. Organization of innovative activity in the enterprise.	

	Development of the project "Longitudinal study of creativity development in solving non-standard tasks".	
Pedagogical innovation. Innovative methods of training and education that improve the quality of education	The concept of scientific innovation. Signs of innovation. The theory of innovative development, and specifics of the innovation. Pedagogical improving innovation. Analysis of possible innovations in the field of theory and methods of professional education. Blended learning, OER and MOOCs in education.	
Methodology of professional development of a teacher-researcher	Model of a competitive higher school teacher. Stages of professional development of a teacher-researcher. Methodology of pedagogical research. Competitions of professional skill and methodical work as a form of training of a teacher-researcher. Project " Development of a personal educational track and mechanisms for its implementation»	
Psychological and pedagogical bases of organization of students creative development	The role of creative self-development of the student in ensuring the quality of education. Reflection of activity and projecting a personal educational track. Activity of the tutor. Methodology for developing components of the developing digital educational environment. Organization of creative self-development of the student and its methodological support Development of the project " Complex of creative tasks for self-development in engineering discipline»	

IV – ASSESSMENT PROCEDURE

Self-Assessment
Provide example sheets, paper & pencil versus computer-aided worked examples

Teacher´s Assessment

- Test – 10%
- Creative essay -10%
- Realization of the project -50%
- Implementation of practical tasks - 20%
- Group discussion – 10%

ASSESSMENT TOOLS

ASSESSMENT TOOL 1

NAME	Tool 1
TOOL TYPE	Test
ASSESSMENT TYPE	diagnostic
IMPLEMENTATION	Performed with the use of information technology

DESCRIPTION	Includes 10 closed questions on didactic units corresponding to this learning result
CRITERIA, RUBRICS, RATING SCALES	At least 70% of correct answers for mastering the threshold level

ASSESSMENT TOOL 2

NAME	Tool 2
TOOL TYPE	Creative essay
ASSESSMENT TYPE	forming
IMPLEMENTATION	Within 10-15 minutes, the student presents his / her point of view on the problem situation in writing
DESCRIPTION	Analysis of the problem situation
CRITERIA, RUBRICS, RATING SCALES	

Description of the result of the student's activity	Grade	
The task is not fulfilled	0	
The subject of the task is not disclosed	1	
The subject of the task is not fully disclosed, but there are conceptual provisions of the student's view of the problem	2	
The task was completed, but there are contradictions in the arguments and statements that do not correspond to the current state of science	3	
The task is completed, showing the possession of the main provisions of this section of the discipline	4	
The task was completed and the creative perception of modern approaches to solving the problem was demonstrated	5	

ASSESSMENT TOOL 3

NAME	Tool 3
TOOL TYPE	Realization of the project
ASSESSMENT TYPE	Summing up
IMPLEMENTATION	Project activity
DESCRIPTION	Implementation of the project based on materials of the discipline module

CRITERIA, RUBRICS, RATING SCALES

1. *Text of the project (for each item, one grade is selected that corresponds to a high level of quality of the task, sufficient or threshold; the result is summed up)*

Description of the result of the student's activity	Grade
Validity of project direction choice	3/2/1
Validity of innovation choice	3/2/1
Completeness of the project description	5/3/1
Clear vision of the problems and prospects of the project	3/2/1
The mechanism of practical implementation of the propositions put forward by the author is described	5/3/1

2. *Presentation and protection of the project (assessment is based on one of the criteria)*

Description of the result of the student's activity	Grade
The work is not presented	0
The content of the oral report on the project topic does not fully disclose its main provisions	2
The content of the oral message on the project topic reveals its topic by main positions	4
The content of the oral message on the project topic fully reveals its topic	6
The content of the oral report on the project topic fully reveals its topic, in addition, the presentation was made in compliance with the principles of science and clarity	8
The content of the oral message on the project topic fully reveals its topic, the presentation is additionally made in compliance with the principles of science and clarity, the student speaks convincingly and answers questions from participants of the educational process	10
The content of the oral report on the project topic fully reveals its theme, the presentation is additionally made in compliance with the principles of science and clarity, the student speaks convincingly and answers questions from participants of the educational process, and charismatic leadership is demonstrated: inspiration, the ability to prove his point of view	11

3. *Discussion of projects of other students (assessment according to one of the criteria, one for participation in all project discussions)*

Description of the result of the student's activity	Grade
Did not participate in the discussion, the ideas expressed do not relate to the topic under discussion or contain fundamental errors	0
Mainly stimulus and productive level of intellectual activity in the discussion, poor knowledge of key components of the studied discipline in the context of the discussed creative work, the presence of significant errors in statements	2
Mainly stimulus and productive level of intellectual activity in the discussion, knowledge of the key components of the content of the studied discipline in the context of the discussed project, the absence of significant errors in statements	4
Mainly heuristic level of intellectual activity in the discussion, knowledge and clear understanding of the key components of the content of the studied discipline in the context of the discussed project, building a logical chain of reasoning for obtaining new knowledge in the discussion process	6
Mainly heuristic level of intellectual activity in discussions, knowledge and understanding of the key components of the content of studied discipline in the context of discussion of the project, knowledge of the issues being discussed, understanding of the relationship of the received knowledge in professional activity	8
Creative level of intellectual activity in the discussion, systematized knowledge of the content of the discipline under study in the context of the project under discussion, analysis of problem issues and prospects for the development of the acquired knowledge for the activity	10

The threshold level is 20 points, with at least 12 points for the first section.

ASSESSMENT TOOL 4

NAME	Tool 4
TOOL TYPE	Implementation of practical tasks
ASSESSMENT TYPE	forming
IMPLEMENTATION	Practical task on a given topic is implemented
DESCRIPTION	

CRITERIA, RUBRICS, RATING SCALES	<table><tr><th>Description of the result of the student's activity</th><th>Grade</th></tr><tr><td>The task is not fulfilled</td><td>0</td></tr><tr><td>The task is not fulfilled completely</td><td>1</td></tr><tr><td>When performing the task, fundamental errors were made in the use of psychological and pedagogical knowledge</td><td>2</td></tr><tr><td>The task was completed, but there are small errors in the reasoning and application of psychological and pedagogical knowledge</td><td>3</td></tr><tr><td>The task is fully completed</td><td>4</td></tr><tr><td>The task was completed, and the knowledge of psychological features of educational process organization is shown</td><td>5</td></tr></table> Threshold value of at least 3 points

ASSESSMENT TOOL 5

NAME	Tool 5
TOOL TYPE	Group discussion in the electronic information and educational environment of the University
ASSESSMENT TYPE	Summing up
IMPLEMENTATION	
DESCRIPTION	
CRITERIA, RUBRICS, RATING SCALES	*Participation in a group discussion (assessment according to one of the criteria, one for participation in the discussion on the forum of one section of the discipline)* <table><tr><th>Description of the result of the student's activity</th><th>Grade</th></tr><tr><td>Did not participate in the discussion, the ideas expressed do not relate to the topic under discussion or contain fundamental errors</td><td>0</td></tr><tr><td>Mainly stimulus and productive level of intellectual activity in the discussion, poor knowledge of the key components of the discipline under study in the context of the issue under discussion, the presence of significant errors in statements</td><td>2</td></tr><tr><td>Mainly stimulus and productive level of intellectual activity in the discussion, knowledge of the key components of the content of the studied discipline in the context of the discussed issue, the absence of significant errors in statements</td><td>4</td></tr><tr><td>Mainly heuristic level of intellectual activity in discussions, knowledge and understanding of the key components of the content subjects are studied in the context of the subject matter, building a logical chain of reasoning to gain new knowledge in the process of discussion</td><td>6</td></tr><tr><td>Mainly heuristic level of intellectual activity in discussions, knowledge and understanding of the key components of the content subjects are studied in the context of the subject matter, knowledge of the issues being discussed, understanding of the knowledge obtained in the general structure of scientific knowledge in educational psychology, the relationship of the knowledge obtained from professional activities</td><td>8</td></tr><tr><td>The creative level of intellectual activity in discussions, systematic knowledge of the content of studied discipline in the context under discussion, an analysis of problematic points and prospects of development of the acquired knowledge for the successful development of engineering education</td><td>10</td></tr></table> The threshold value is not less than 6 points.

ASSESSMENT TOOLS VERSUS OUTCOMES

OUTCOMES	TOOL 1	TOOL 2	TOOL 3	TOOL 4	TOOL 5
O1	**x**	x			x
O2	x	x			x
O3	**x**	x	x		x
O4	x	x		x	x
O5	**x**	x		x	x
O6	x	x	x		x
O7	**x**	x	x		x
O8	x	x	x		x
O9	x	x	x		x

ASSESSMENT: ACHIEVED LEVEL OF LEARNING OUTCOMES (TO BE FILLED DURING OR AT THE END OF THE COURSE)

OUTCOME	NOT IMPLEMENTED	ATTEMPTED IMPLEMENTATION	MANY DEFECTS	SOME DEFECTS	MINOR DEFECTS	CORRECT	EXCEPTIONAL
O 1							
O 2							
…							
O n							

Levels of outcomes' achievement correspond to:

- **Exceptional** - exceeded all goals; applied knowledge to new situations and / or solved standard problems competently
- **Correct** - achieved all objectives in a minimally competent manner; applied the knowledge and skills to known standard cases
- **Minor defects** - achieved the most important goals competently; denoted some shortcomings
- **Some defects** - reached the objectives in general computation; demonstrated some weaknesses/defects
- **Many defects** - achieved only minimum goals; demonstrated many weaknesses/defects
- **Attempted Implementation** - failed to meet minimum objectives; demonstrated some skills
- **Not Implemented** - have not demonstrated a minimally significant set of skills; violated fundamental principles of engineering science / pedagogy and / or nothing minimally acceptable was produced

NOTES (PRIVATE/RESTRICTED TO THIS FORM)

NOTES (PUBLIC/TO BE AVAILABLE ONLINE)

SYLLABUS FOR COURSE 2.4. INTERACTION WITH STAKEHOLDERS

INSTITUTION:	**TO BE FILLED LATER**
PROGRAM:	**iPET 2**
COURSE:	**2.4. INTERACTION WITH STAKEHOLDERS**

I – IDENTIFICATION

COMPULSORY COURSE	CONTACT TIME - HOURS				SELF-STUDY - HOURS	CREDITS ECTS
	LECTURES	TUTORIALS	PRACTICAL /PROJECT	TOTAL		
INTERACTION WITH STAKEHOLDERS	14	2	4	20	5	1

FORMAL PREREQUISITES (IF ANY):

COURSE WEBSITE URL: TO BE FILLED LATER

II – AIMS, SYNOPSIS, CHARACTERIZATION

Background (max. 600 characters)

Higher education institutions need to identify key stakeholders and their needs before defining priorities and relational strategies for each entity. This way, the aim of this module is to identify main stakeholders in a particular university (faculty) and to ensure efficient interaction with the identified parties of interest. The university mission was expanded to stretch beyond teaching and research to include services to the community requiring partnerships be established with their surrounding communities and stakeholders. Meeting the needs of these individuals or groups is an important competitive factor for higher education institutions. In general, **the student is considered the most important of stakeholders. Other important stakeholders are: academic community, researchers, employers and industry representatives, professional bodies, international and national professional organisations, former students,** etc.

Aims – overview (max. 750 characters)

The main aims are:

- to improve communication skills needed for an interaction with identified group of stakeholders: excellent oral and written, as well as both verbal and nonverbal communication skills needed in an interaction with stakeholders
- to master approaches and technologies that allow interacting with stakeholders belonging to different typological groups
- to detect and minimize emerging risks, and develop productive interaction strategies

Specific Aims (max. 1000 characters)

Analysis of potential stakeholders (identified above) in the context of education:

- To analyze potential stakeholders (their roles, level of competencies, expectations, requirements for the project/product/course and the level of impact on the project/product/course **(O1)**
- To apply proper technologies and tools for interaction with different kind of stakeholders **(O2)**

Interaction with academic/scientific environment:

- To write and publish research papers in an engineering field **(O3)**
- To prepare and give efficient scientific presentations **(O4)**
- To prepare, design and present effective research posters, E-mails, academic CV and cover letters **(O5)**

Interaction with business/industry representatives:

- To carry out business communication and cooperation with business/industry representatives, coordination of interaction in the work situation for a common result **(O6)**
- To predict and minimize future risks caused by stakeholders' activities for the university-enterprise project/product/course **(O7)**

Contents (max. 1000 characters)

Unit 1 - Classification and identification of stakeholders

1.1. Analysis of stakeholders and their expectations, their activity levels (uninformed, resisting, neutral, supportive, leader), as well as levels of interaction with various groups of stakeholders

1.2. Modification of strategies for interaction with stakeholders belonging to different typological groups

Unit 2 - Technologies and tools for interaction with stakeholders

2.1. Visualization tools for the stakeholder environment

2.2. Technologies for conducting peer review and meetings

2.3. Methods of communication with stakeholders. Features and content of: interactive communication, push-communication, pull-communication

Unit 3 – Writing and publishing a research paper in an engineering field

3.1 Writing for and publishing in scientific journals, from choosing a suitable journal, to writing each part of the paper

3.2 Submitting the paper and responding to peer review, checking the proofs, ethical issues

Unit 4 – Preparing and giving scientific presentations

4.1 Showing the differences between strong and weak presentations, identifying the errors

4.2 Delivering a presentation clearly, coherently and confidently, in a friendly and accessible style

4.3 Creating visual aids and structuring presentations

4.4 Nonverbal communication

Unit 5 – Preparing, designing and presenting effective research posters, E-mail writing, writing academic CV and cover letter

Unit 6

6.1. Tools and models of innovative products, solutions and technologies transfer from university to industry and vice versa (start-ups and spin-offs models and cases etc,)

Unit 7

7.1 Methods of forming strategic positions in the implementation of a project and/or programme, including technologies aimed at minimizing potential conflicts (avoidance, reconciliation, compromise, adaptation, etc.)
7.2 Strategies to increase stakeholders' support
7.3 Strategies aimed at reducing the negative impact and risks caused by stakeholders' activities

Main Teaching Material

1. The Future of University-Business Cooperation · August 2017, Todd Davey, Carolin Plewa, Balzhan Orazbayeva, Victoria Galan-Muros // https://www.researchgate.net/publication/320057445_The_Future_of_University-Business_Cooperation
2. Web-resources: https://www.ub-cooperation.eu/
3. Bozeman, B., Fay, D., and Slade, C. (2013). "Research collaboration in universities and academic entrepreneurship: the-state-of-the-art." The Journal of Technology Transfer, 38(1), 1-67.
4. Heather Silyn-Roberts: Writing for Science and Engineering: Papers, Presentations and Reports. 2013, Elsevier Ltd. 208 pp. ISBN: 978-0-08-098285-4
5. Michael Alley: The craft of scientific presentations. Springer, New York, 2013. ISBN 978-1-4419-8278-0, 978-1-4419-8279-7

Complementary Teaching Material

1. Rasmussen, E., and Wright, M. (2015). "How can universities facilitate academic spin-offs? An entrepreneurial competency perspective." The Journal of Technology Transfer, 1-18.
2. Moutinho, R. et all (2014). "Determinants of knowledge-based entrepreneurship: an exploratory approach". Int Entrep Manag J; DOI 10.1007/s11365-014-0339-y, p.17
3. Bozeman, B., Fay, D., and Slade, C. (2013). "Research collaboration in universities and academic entrepreneurship: the-state-of-the-art." The Journal of Technology Transfer, 38(1), 1-67.
4. A Guide to the Project Management Body of Knowledge (PMBOK®Guide),5th Edition, Project Management Institute (PMI), 2012.
5. Angermeier G. Zielkreuz, Das ProjektMagazin, das Fachhortal für Projekt-management. https://www.projektmagazin.de/glossarterm/zielkreuz/.
6. Freeman R.E. Strategic Management: a Stakeholder Approach. — Boston: Pitman, 1982.
7. Taleb N.N.The Black Swan: The Impact of Highly Improbable. — NY: Random House, 2007
8. Blaxter, Loraine, Hughes, Christina, Tight, Malcolm: How To Research. McGraw-Hill Education (UK), 2010, 315 pp. ISBN 033523867X, 9780335238675
9. Barbara Gastel, Robert A. Day: How to Write and Publish a Scientific Paper. 8th Edition, Cambridge University Press; 2017. 344 pp. ISBN 1316640434, 978-1316640432

Teaching/Learning Tools

MS Office including PowerPoint / alternatively Prezi presentation tool
Graphical software for developing scientific posters according to the availability at particular institution / recommended - Adobe Illustrator, LaTeX beamerposter package, Microsoft Publisher, Microsoft PowerPoint

Previous knowledge assumed as acquired

Material	Source
-	-

Teaching/Learning methodology

- Lecturing
- Demonstrating
- Classroom discussion
- Active learning
- Project based learning
- E-learning / blended learning
- Teamwork
- Technology enhanced learning

Characterization of objectives and course program
A – Estimated percentage distribution of pedagogical and technological content
Pedagogical component (establishes and develops pedagogical basis) – 60 %
Technological component (applies to design and process operation) – 40 %

Characterization of objectives and course program
B – Outcomes – in conformity with EUR-ACE criteria (later on we will adjust this to the ENTER Standards)

Group of outcomes	Outcome (number & name)
Knowledge and Understanding	To analyze potential stakeholders (O1) To apply proper technologies and tools for interaction with different kind of stakeholders (O2) To carry out business communication and cooperation with business/industry representatives (O6) To predict and minimize future risks caused by stakeholders' activities for the university-enterprise project/product/course (O7)
Organization of students' Engineering Analysis	To analyze potential stakeholders (O1) To apply proper technologies and tools for interaction with different kind of stakeholders (O2) To carry out business communication and cooperation with business/industry representatives (O6) To predict and minimize future risks caused by stakeholders' activities for the university-enterprise project/product/course (O7)

Organization of students' Engineering Design	To prepare, design and present effective research posters, E-mails, academic CV and cover letters (O5)
Organization of students' Investigations	To write and publish research papers (O3)
Organization of students' Engineering Practice	To analyze potential stakeholders (O1) To apply proper technologies and tools for interaction with different kind of stakeholders (O2) To carry out business communication and cooperation with business/industry representatives (O6) To predict and minimize future risks caused by stakeholders' activities for the university-enterprise project/product/course (O7)
Transferable Skills	To analyze potential stakeholders (O1) To apply proper technologies and tools for interaction with different kind of stakeholders (O2) To write and publish research papers (O3) To prepare and give efficient scientific presentations (O4) To prepare, design and present effective research posters, E-mails, academic CV and cover letters (O5) To carry out business communication and cooperation with business/industry representatives (O6) To predict and minimize future risks caused by stakeholders' activities for the university-enterprise project/product/course (O7)

III – PLANNING

COMPULSORY UNITS of the Course	**SUMMARY**	**OBSERVATIONS**
1) Classification and identification of stakeholders	1.1. Analysis of stakeholders and their expectations, their activity levels (uninformed, resisting, neutral, supportive, leader), as well as levels of interaction with various groups of stakeholders 1.2. Modification of strategies for interaction with stakeholders belonging to different typological groups	Interaction of teacher and trainee Cont. hrs. 2 Outcomes: panel discussion
2) Technologies and tools for interaction with stakeholders	2.1. Visualization tools for the stakeholder environment. 2.2. Technologies for conducting peer review and meetings.	Interaction of teacher and trainee Cont. hrs. 2 Outcomes: panel discussion

	2.3. Methods of communication with stakeholders. Features and content of: interactive communication, push-communication, pull-communication.	
3) Writing and publishing a scientific paper in engineering	This part of the course will focus on writing for and publishing in scientific journals, from choosing a suitable journal, to writing each part of the paper, up to submitting the paper and responding to peer review, through checking the proofs. This part of the course is essential in learning how to create powerful documents.	Interaction of teacher and trainee Cont. hrs. 2 Practical project hrs. 2 Self-study and autonomous hrs. 2 Outcomes: written document
4) Preparing and giving scientific presentations	It aims to strengthen trainees as presenters of science and engineering research results. It will provide the essential guide to the most transferable of all trainees' skills: delivering a presentation clearly, coherently and confidently, in a friendly and accessible style. It will help trainees to acquire the skills they need to deliver effective presentations especially in an international environment. It will provide trainees with practical guidance on creating visual aids and structuring presentations.	Interaction of teacher and course participant Cont. hrs. 2 Practical project hrs. 1 Self-study and autonomous hrs. 2 Outcomes: Oral presentation with a support of visuals
5) Scientific posters, E-mails, academic CV and cover letters	To prepare, design and present effective research posters, E-mails, academic CV and cover letters	Interaction of teacher and course participant Cont. hrs. 2 Practical project hrs. 1 Self-study and autonomous hrs. 2 Outcomes: Poster design, CV and cover letter, e-mail communication
6) University – enterprise interaction	6.1. Tools and models of innovative products, solutions and technologies transfer from university to industry and vice versa (start-ups and spin-offs models and cases etc.)	Interaction of teacher and trainee Cont. hrs. 2 Outcomes: case study
7) Stakeholders' risks management	7.1 Methods of forming strategic positions in the implementation of a project and / or program, including technologies aimed at minimizing potential conflicts (avoidance, reconciliation, compromise, adaptation, etc.) 7.2 Strategies to increase stakeholders' support, 7.3 Strategies aimed at reducing the negative impact and risks caused by stakeholders' activities.	Interaction of teacher and trainee Cont. hrs. 2 Outcomes: case study

IV – ASSESSMENT PROCEDURE
Self-Assessment

– discussion (whole-class or small-group) – trainer-trainee interviews – anonymous feedback sheets
Teacher´s Assessment Oral assessment of trainee's portfolio (research paper, scientific poster, oral presentation and possible written outcomes – CV, cov. letter), evaluation of participation in discussion.

ASSESSMENT TOOLS (ONE TABLE FOR EACH TOOL)

ASSESSMENT TOOL 1

NAME	**TOOL 1** Portfolio evaluation:
TOOL TYPE	Research paper, Scientific poster, Oral presentation with a support of Power Point
ASSESSMENT TYPE	formative, summative
IMPLEMENTATION	Individual project presentation of previously delivered portfolio outcomes
DESCRIPTION	Trainees demonstrate a complex of outcomes in an effective manner to present ability to respond to the educational content
CRITERIA, RUBRICS, RATING SCALES	Portfolio evaluation (upon theoretical background fulfilments): – Checklist will ensure that all necessary pieces are included. 25% – Evaluate if the work is completed correctly, 25% – Evaluate if the work is complete (information), 25% – Evaluate if the work is completed comprehensively (depth) 25% Each area is marked on a scale of 1-5. Scale is 1 = not at all; 2 = somewhat; 3 = mostly; 4 = entirely and 5 = above expectations.

ASSESSMENT TOOL 2

NAME	**TOOL 2**
TOOL TYPE	Group discussion
ASSESSMENT TYPE	Forming
IMPLEMENTATION	The problem situation is discussed, the listeners give their opinion
DESCRIPTION	Analysing the problem situation, determining the causes and finding solutions
CRITERIA, RUBRICS, RATING SCALES	Evaluated: - Argumentativeness of the answer; 25% - specificity of proposals; 25% - relying on experience; 25% - feasibility of the proposed solutions. 25%

ASSESSMENT TOOL 3

NAME	**TOOL 3**
TOOL TYPE	Case simulation
ASSESSMENT TYPE	Forming
IMPLEMENTATION	Practical tasks performed by listeners

DESCRIPTION	Each student applies an individual case and checks with the teacher the models of practical situations solutions, how realistic/reasonable the results presented are.
CRITERIA, RUBRICS, RATING SCALES	The evaluation consists of three parts: case application, results and conclusions.

ASSESSMENT TOOL 4

NAME	**TOOL 4**
TOOL TYPE	Test
ASSESSMENT TYPE	Summing up
IMPLEMENTATION	Performed using information technology
DESCRIPTION	Includes 10 closed questions. It is held after each section of the discipline.
CRITERIA, RUBRICS, RATING SCALES	At least 65% of correct answers

ASSESSMENT TOOLS VERSUS OUTCOMES

TOOLS / OUTCOMES	TOOL 1	TOOL 2	TOOL 3	TOOL 4
OUTCOME 1		x		x
OUTCOME 2		x		x
OUTCOME 3	x			
OUTCOME 4	x			
OUTCOME 5	x			
OUTCOME 6			x	x
OUTCOME 7			x	x

ASSESSMENT: ACHIEVED LEVEL OF LEARNING OUTCOMES (TO BE FILLED DURING OR AT THE END OF THE COURSE)

OUTCOME	NOT IMPLEMENTED	ATTEMPTED IMPLEMENTATION	MANY DEFECTS	SOME DEFECTS	MINOR DEFECTS	CORRECT	EXCEPTIONAL
OUTCOME 1							
OUTCOME 2							
…							
OUTCOME N							

Levels of outcomes' achievement correspond to:

- **Exceptional** - exceeded all goals; applied knowledge to new situations and / or solved standard problems competently
- **Correct** - achieved all objectives in a minimally competent manner; applied the knowledge and skills to known standard cases
- **Minor defects** - achieved the most important goals competently; denoted some shortcomings

- **Some defects** - reached the objectives in general computation; demonstrated some weaknesses/defects
- **Many defects** - achieved only minimum goals; demonstrated many weaknesses/defects
- **Attempted Implementation** - failed to meet minimum objectives; demonstrated some skills
- **Not Implemented** - have not demonstrated a minimally significant set of skills; violated fundamental principles of engineering science / pedagogy and / or nothing minimally acceptable was produced

NOTES (PRIVATE/RESTRICTED TO THIS FORM)

NOTES (PUBLIC/TO BE AVAILABLE ONLINE)

SYLLABUS FOR COURSE 2.5. SUSTAINABLE DEVELOPMENT

INSTITUTION:	**TO BE FILLED LATER**
PROGRAM:	**iPET 2**
COURSE:	**2.5. SUSTAINABLE DEVELOPMENT**

I – IDENTIFICATION

COMPULSORY COURSE	CONTACT TIME - HOURS				SELF-STUDY - HOURS	CREDITS ECTS
	LECTURES	TUTORIALS	PRACTICAL /PROJECT	TOTAL		
SUSTAINABLE DEVELOPMENT	**5**	**10**	**5**	**20**	**5**	**1**

FORMAL PREREQUISITES (IF ANY):

COURSE WEBSITE URL: TO BE FILLED LATER

II – AIMS, SYNOPSIS, CHARACTERIZATION

Background (max. 600 characters)

In 2015 the 193 members of the United Nations agreed to achieve **17 Sustainable Development Goals (SDGs)** by 2030. This Agenda also considers education to be one of the leading influencers and drivers of the sustainable future. Professional actions of engineers influence directly the quality of life of the mankind; they have to be aimed at health protection, safety and wellbeing of people. Traditional education gives educators few opportunities to explore and solve real world problems. The Engineering Education for SD can be used as a framework. The best way to achieve this is through making sustainability an integral part of the curriculum and follow an integrated approach to teaching SD.

Aims – overview (max. 750 characters)

This course is designed to help engineering educators to improve and develop their knowledge, understanding, skills and abilities to teach students to recognize that engineers operates in a broad societal context and to take that context into account in their professional activity.
The main aim of the course is to develop strategy to incorporate sustainable development principles into engineering education at large, including specific engineering courses.

Specific Aims (max. 1000 characters)

- **Develop SD mindsets, both on a professional and personal level.** *Most important mindsets in the domain of SD for engineering are critical thinking, holistic, systems thinking, entrepreneurial thinking, global mindset, cultural agility, and valuing learning over knowing. These are thinking modes that cannot be imitated by (networks of) intelligent machines and are unique for people i.e. social responsibility.*

- **Design learning for human needs.** *A major goal of higher education in the 21st century is to shift the learners' mind that learning is not just the acquisition of knowledge and skills, but a human quality and dispositions to cope with the uncertain world, a complex life and a changing work environment, and to tackle the big challenges such as the UN SDG. It requires pedagogies that focus on gaining skills to learn and relearn, and the agility to change perspectives. It implies that the current faculty-centered curricula (anchored by existing physical spaces, staff resources, time-bound schedules) have to be transformed into (more) learner-centered and meaningful curricula with freedom of choice for the students.*
- **Promoting impact-focused education.** *Impact-focused education accentuates experiential learning and is meaningful for educators. It requires the accentuation of the relationship between engineering and society, where societal relevance should be the center of engineering. Increasingly curricula have to involve thematic studies across disciplines, human-centered and project-based learning with real-world connections and integrate work-based learning. Learning in randomness outside the academic cloister is the most effective teacher, but only when it is combined with student self-reflection and self-awareness.*
- **Develop the necessity the analysis through the prism of a green society.** *How the education and green education program can help technologies more sustainable by counting and promoting green element to evade ecological depletion and rehabilitated green technology to endow with the uncontaminated and unpolluted world for the next generation.*
- **Nurture a culture of experimentation and innovation.** *Educational change has to be drawn on feedback, evidence and ideas from across the university hierarchy, and beyond the university. The educators should nurture an educational culture of continuous experimentation and innovation and be prepared to accept failure. Be prepared for a future deregulating education environment (flexibility in rules and regulations), where the staff experimenting, and innovating education are important enablers of changing educational culture. It's not the institution that causes change, but it is the people.*
- **Integrate scientific and professional integrity in the curricula.** *The role, responsibilities and ethics of engineers in society (solving human challenges and problems facing society) should be the focus of the SD engineering education.*
- **Strengthening university-industry collaboration.** *Universities have to aggressively engage with industry to co-design curricula and course content, collaborate on applied research, and offer work-integrated learning. Especially in this age of acceleration and digitalization this requires a strong and enduring partnership between industry and academia.*
- **Empower students to foster leadership and ethical behavior.** *The changing paradigms mean that engineering professionals have to be agile and resilient, and need skills that go beyond the 'traditional' engineering skills, thus the students must be trained with holistic thinking, the ability to work in interdisciplinary global teams, and exert ethical leadership.*

Contents (max. 1000 characters)

- Introduction to Sustainable Development: 17 Sustainable Development Goals (10%)
- Engineering Curriculum and Education for Sustainable Development (20%)
- Pedagogical strategies for learning sustainability in engineering education (30%)
- SDG Challenge as the capstone project (25%)
- Extracurricular activities to foster SD ethos (15%)

Main Teaching Material

1. Sustainable Development for Engineers: A Handbook and Resource Guide, by Karel Mulder, 2006
2. *New developments* in *engineering education* for *sustainable development* / *Walter Leal Filho, Susan Nesbit, editors*. Switzerland : Springer, 2017

3. Subarna Sivapalan, Michael J. Clifford & Sarah Speight (2016) Engineering education for sustainable development: using online learning to support the new paradigms, Australasian Journal of Engineering Education, 21:2, 61-73, DOI: 10.1080/22054952.2017.1307592
4. World Federation of Engineering Organizations, WFEO Engineers for a sustainable post 2015, Congress on Engineering Education for Sustainable Development, 2015.
5. Huntzinger, D.N., Hutchins, M.J., Gierke, J.S., Sutherland, J.W., 2007. Enabling sustainable thinking in undergraduate engineering education. International Journal of Engineering Education, 23(2), 218-230 (2007)

Complementary Teaching Material

1. Graham, R. (2018). The global state of the art in engineering education. Technical Report, Massachusetts Institute of Technology, Cambridge.
2. Grasso, D., & Burkins, M. (2010). Holistic engineering education: Beyond technology. Springer Science & Business Media.
3. Henderikx, P., & Jansen, D. (2018). The changing pedagogical landscape: In search of patterns in policies and practices of new modes of teaching and learning.
4. Kamp, A. (2016). Engineering Education in the Rapidly Changing World: Rethinking the Vision for Higher engineering Education. Delft: TU Delft, Faculty of Aerospace Engineering.
5. UN (2015). 2030 Agenda for Sustainable Development

Teaching/Learning Tools

No tools required.

Previous knowledge assumed as acquired

No specific requirements

Material	Source
-	-

Teaching/Learning methodology

- PBL
- Forum Theater
- Jigsaw
- Team-work
- Case study

Characterization of objectives and course program

A – Estimated percentage distribution of pedagogical and technological content

- Pedagogical component (establishes and develops pedagogical basis) – 70 %
- Technological component (applies to design and process operation) – 30 %

Characterization of objectives and course program

B – Outcomes – in conformity with EUR-ACE criteria (later on we will adjust this to the ENTER Standards)

Group of outcomes	Outcome (number & name)
Knowledge and Understanding	O1 – Nurture mindsets and meanings in curricula; O2 – Develop agile curricula with flexibility and freedom of choice for the students;
Organization of students' Engineering Analysis	O3 – Develop the necessity of the analysis through the prism of green technologies;
Organization of students' Engineering Design	O4 – Promote impact-focused education through interdisciplinary student-centred projects with societal relevance (where societal relevance is the centre of engineering).
Organization of students' Investigations	O5 – Nurture a culture of experimentation and innovation in education on a limited scale, within a strategy for implementing more widely successful innovations;
Organization of students' Engineering Practice	O6 – Integrate scientific and professional integrity and business ethics in engineering curricula; O7 – Intensify the collaboration with industrial partners and create more opportunities for engineering practitioners in the classroom, engineering projects and internships at companies;
Transferable Skills	O8 – Empower students (intra- and extracurricular) to foster leadership, ethical behaviour, deep collaboration, interdisciplinarity and creativity.

III – PLANNING

COMPULSORY UNITS of the Course (including self-guided learning)	SUMMARY	OBSERVATIONS
Introduction to Sustainable Development: 17 Sustainable Development Goals	This unit presents UN Sustainable Development Goals from an engineering education perspective. The 2030 Agenda encompasses 17 broad and interrelated Sustainable Development Goals (SDGs). The focus is made on transformation of outcomes and results from engineering education and research into real-life: notable impacts are fundamental for improving quality of life, increases in productivity and	• Jigsaw 2,5 hours All Outcomes

	associated growth in trade and access to education and work at regional, national and global levels.	
Engineering Curriculum and Education for Sustainable Development	Sustainable development is a complex concept which concerns a wide range of social, techno-economic and environmental issues. Without addressing all these dimensions, teaching of sustainable development would not be complete. This unit intends to provide deep understating and develop competences how to integrate specific sustainability topics in courses and to have a separate course in sustainable development (where it is appropriate) to ensure that general aspects of sustainable development are included and that a team of faculty takes full responsibility for this. Complete lifecycle of products and systems projects are shown to be suitable tools for integrating teaching and learning of sustainable development.	• Team-work • Case study 5 hours All Outcomes
Pedagogical strategies for learning sustainability in engineering education	This unit conceptualizes learning and education for sustainable development, analyses the shift and transformation in the pedagogy used in Engineering Education Institutions needed to train engineers for sustainability. Learning strategies, techniques and activities are dominated and their role to facilitate the shift to Education for Sustainable Development in Higher Education Institutions is analyzed.	• Forum Theater 7,5 hours All Outcomes
SDG Challenge as the capstone project	This unit is dedicated to develop guidelines how to integrate sustainability aspects in students' engineering projects, finalizing by introducing SDG Challenge as the capstone project	• PBL 6,25 hours All Outcomes

Extra-curricular activities to foster SD ethos	This unit is aimed at developing specific university environment required to train engineers of the 21st century, focusing on the set of possible extra-curricular activities that need to be organized and implemented in order to foster SD ethos	• Team work • Benchmarking 3,75 hours All Outcomes

IV – ASSESSMENT PROCEDURE
Self-Assessment Initial diagnosis of SD ethos of enrolled educators, not impacting the course evaluation
Teacher´s Assessment Portfolio

ASSESSMENT TOOLS

NAME	Final assessment
TOOL TYPE	Project development and presentation
ASSESSMENT TYPE	Formative& summative
IMPLEMENTATION	Individual project presentation of previous delivered portfolio report
DESCRIPTION	In the final task of this course, educators will need to develop their own strategy in integrating SD in a real course (given by them at their HEIs) in order to demonstrate how they have acquired the skills and knowledge to ensure SD ethos among engineering educators.
CRITERIA, RUBRICS, RATING SCALES	Portfolio evaluation: 1 - Checklist will ensure that all necessary pieces are included. (25%) 2 – Evaluate if the work is completed correctly (mechanics), (25%) 3 – Evaluate if the work is complete (information), (25%) 4 – Evaluate if the work is completed comprehensively (depth) (25%) Each area is marked on a scale of 1-5. Scale is 1 = not at all; 2 = somewhat; 3 = mostly; 4 = entirely and 5 = above expectations.

ASSESSMENT TOOLS VERSUS OUTCOMES

TOOLS / **OUTCOMES**	**TOOL 1**
OUTCOME 1	X
OUTCOME 2	X
OUTCOME 3	X
OUTCOME 4	X
OUTCOME 5	X
OUTCOME 6	X
OUTCOME 7	X
OUTCOME 8	X

ASSESSMENT: ACHIEVED LEVEL OF LEARNING OUTCOMES (TO BE FILLED DURING OR AT THE END OF THE COURSE)

OUTCOME	NOT IMPLEMENTED	ATTEMPTED IMPLEMENTATION	MANY DEFECTS	SOME DEFECTS	MINOR DEFECTS	CORRECT	EXCEPTIONAL
OUTCOME 1							
OUTCOME 2							
…							
OUTCOME N							

Levels of outcomes' achievement correspond to:

- **Exceptional** - exceeded all goals; applied knowledge to new situations and / or solved standard problems competently
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CONCLUSION

This deliverable serves as the basis for further development of iPET-2 courses. Based on the proposed syllabuses for each course, the consortium plans to prepare a thorough content plan for each course, as well as to develop a general presentation of course materials, including mandatory content of the lectures, structure, methodology and basic tasks for practical, project and self-study work. The proposed syllabuses will be applied within the trial iPET program training of engineering educators and will be revised, if needed, before the final launch of iPET programs.