Course code A.1. **Course item** ……

1. INFORMATION ABOUT THE COURSE

A. Basic information

Course title	Hot topics in modern physics
Field of study	Computer Aided Engineering
Cycle	*Second*
Study profile	*Academic*
Study mode	*Full-time*
Specialisation	*Not relevant*
Unit responsible for the field of study	*Faculty of Mechanical Engineering*
Lecturer	*Dr hab. Sylwia Zielińska, Prof. nadzw. UTP*
Introductory courses	*Elementary physics, advanced mathematics*
Prerequisites	*Knowledge of mathematical analysis, algebra, informatics*

B. Semester/ weekly timetable

Semester	Lectures	Classes	Laboratories	Project classes	Seminars	Field experience	ECTS credits
I	15	-	-	-	-	-	1

LEARNING OUTCOMES (acc. to National Qualifications Framework)

No.	Description of learning outcomes	Reference to learning outcomes for the field of study	Reference to learning outcomes for the area of study
KNOWLEDGE			
K1	Student knows and understands fundamental concepts of contemporary physics	CAE_W01	T2A-W02
K2	The student knows and understands the basic concepts and laws of physics	CAE_W10	T2A-W01
K3	The student knows basic facts in physics of particles, quantum optics, quantum information, nanoscience	CAE_W10 CAE_W02	T2A-W01 T2A_W03
SKILLS			
S1	Student is able to search information in scientific literature	CAE_U07	T2A-U01
S2	Student is able indicate the further direction of selfeducation	CAE_U10	T2A_U05
SOCIAL COMPETENCES			
SC1	Understands necessity of self-learning	CAE_K01	T2A_K01

2. TEACHING METHODS

multimedia lecture, discussion

2. METHODS OF EXAMINATION

colloquium, written report on chosen type of subjects at the end of the course

3. COURSE CONTENT

Specify the content separately for each type of classes in accordance with point I.B.	LECTURES. I. Standard model of elementary particles; “missing Higgs boson”. II. Photons statistics. III. Photon bunching antibunching, squeezed light. IV. Introduction to laser cooling. V. Bose-Einstein condensation. VI. Electromagnetically induced transparency. VII. Slow and stored light. VIII. Experimental realization of light storage. IX. Quantum cryptography. X. Qubits - quantum bits, i.e. introduction to quantum informatics. XI. Quantum logic gates and circuits. XII. Quantum information processing and quantum computing. XIII. Quantum teleportation and entanglement. XIV. Left-handed metamaterials. XV. Introduction to nano-physics.

4. VALIDATION OF LEARNING OUTCOMES

(Each learning outcome from the list requires validation methods to ensure that it was achieved by a student.)

Learning outcome	Form of assessment (for example:)					
	Oral examination	Written examination	Colloquium	Project	Report	……
K1			x		x	
K2			x		x	
K3			x		x	
S1			x		x	
S2			x		x	
S3			x		x	

5. LITERATURE

Basic literature	Mark Fox, Quantum optics, Oxford Master in Physics, Oxford University Press, 2006 Pieter Kok and Brendon Lovett, Introduction to optical quantum information processing, Cambridge University Press, 2010 Christofer Gerry, Peter Knight, Introductory quantum optics, Cambridge University Press, 2005 Michel Le Bellac, Introduction a l’information quantique, Editions Belin, Paris 2005
	suggested articles from scientific journals e.g., Nature or Science

Supplementary literature	

6. TOTAL STUDENT WORKLOAD REQUIRED TO ACHIEVE EXPECTED LEARNING OUTCOMES EXPRESSED IN TIME AND ECTS CREDITS

Student's activity	Student workload– number of hours (for example:)
Participation in classes indicated in point 2.2	15
Preparation for classes	5
Reading assignments	5
Other (preparation for exams, tests, carrying out a project etc)	5
Total student workload	30
Number of ECTS credits allocated by the lecturer	**1**
Final number of **ECTS credits (determined by the Programme Council for the Field of Study)**	1