Course Title (in English)	Gauge Theory and Gravitation
Course Title (in Russian)	Калибровочные теории и гравитация
Lead Instructor(s)	Rosly, Alexei

Status of this Syllabus	The syllabus is a final draft waiting for form approval
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1. Annotation

Course Description	The present course could be also entitled 'Classical Field Theory', which menas it deals with all basic material needed in a study of fields preceeding to a study of their quantum properties. This requires in particular understanding such tools as Lagrangian, action functional, field equations (Euler-Lagrange equations). We shall also learn what are the most important symmetry principles which put certain constraints on a field theory. With this are related conservation laws. Typical important symmetries to mention are Lorentz and Poincare symmetry, conformal symmetry, gauge symmetry, general coordinate covariance. A traditional approach to Classical Field Theory has a perfect base in the 2nd volume of Landau-Lifshitz' course. However, since that prominent book was written, new elements came forward, which required more knowledge of differential geometry and topology. In our lecture course, we shall get familiar with most important basic facts from these branches of mathematics with application to field theory. For example, understanding instantons (even at a classical level) requires good knowledge of a number of notions from modern math courses, such as vector bundles, connections, homotopy groups. Therefore our course has to go beyond the reach of Landau-Lifshitz' volume 2.
Course Prerequisites	Student should be familiar with classical mechanics, calculus, and basic geometry.

2. Structure and Content

Course Academic Level	Master-level
Number of ECTS credits	6

3. Assignments

4. Grading

Type of Assessment	Graded

Grade Structure

Activity Type	Activity weight, %
Attendance	40
Final Exam	60

Grading Scale

A:	86
B:	76
C:	66
D:	56
E:	46
F:	0

5. Basic Information

Attendance Requirements	Optional
Course Stream	Science, Technology and Engineering (STE)
Course Delivery Frequency	Every year

Students of Which Programs do You Recommend to Consider this Course as an Elective?

Masters Programs	PhD Programs
Mathematical and Theoretical Physics	

Course Tags	Math Physics

6. Textbooks and Internet Resources

Required Textbooks	ISBN-10 or ISBN-13
L.D. Landau, E.M. Lifshitz (1975). The Classical Theory of Fields. Vol. 2 (4th ed.). Butterworth-Heinemann.	978-0-7506-2768-9

Recommended Textbooks	ISBN-10 or ISBN-13
Green, M. B.; Schwarz, J. H.; Witten, E., Superstring Theory. Vol. 2: Loop amplitudes, anomalies and phenomenology. Cambridge etc., Cambridge University Press 1987. XII, 596 pp.	0 521 32999 X

7. Facilities

8. Learning Outcomes

Knowledge
Classical Field Theory, the Lagrangians and action functionals of main field theories. Main field equations. Basic differential geometry and topology required in field theory.

Skill
Construction of gauge-invariant and/or generally covariant Lagrangians. Derivation of Euler-Lagrange equations in main field theories.

Experience
Solving problems in classical field theory which are most characteristic and basic for modern theoretical physics.

Do you want to specify outcomes in another framework?	Knowledge-Skill-Experience is good enough

9. Assessment Criteria

10. Additional Notes