Course Information

COURSE INFORMATION

Course Title	Code	Semester	L+U Hour	Credits	ECTS
Theory Of Many-Particle Systems I	FZ5029		3 + 0	3.0	7.5

Prerequisites	None

Language of Instruction	Turkish
Course Level	Second Cycle
Course Type	Elective
Mode of delivery	Face to face
Course Coordinator	Prof. Dr. İsmail TARHAN
Instructors	Prof. Dr. Serhat ÖZDER
Assistants	
Course Objectives	The main objective of this course is to provide informations on nonrelativistic many-particle systems, ground-state formalism, Green's function, Fermi systems, Bose systems, linear response and collective modes.
Course Content	The main topics of this course are classical theory of many particles systems, Langrange and Hamilton equations, Green functions and their application, particles in an external electromagnetic field, rigid body, Lorentz transformations, geometry of Minkowski space-time, rotational matrix, spacelike and timelike intervals, Lorentz contraction, classical field theory, Gauge transformation, relativistic wave equations, Klein-Gordon equation, Dirac equation, Dirac equation for fermion and their applications, field quantization, nonrelativistic field theory, perturbation theory, vacuum energy, Bose gas, Bose-Einstein condensation, Fermi gas, degenerate electron gas.
Course Learning Outcomes	1) describe the relativistic Klein-Gordon method for the particles of spin zero. 2) interpret the properties of Fermi particles using Dirac 3) Analyze theories and applications for Fermi and Bose gases. 4) Explain the behaviour of many particle systems 5) Write the fundemantal equations for many-particle systems

WEEKLY COURSE CONTENT

Week	Topics	Teaching and Learning Methods and Techniques	Study Materials
1. Week	Introduction	Oral lectures with interactive discussions	
2. Week	Classical theory of many particles systems, Langrange and Hamilton equations	Oral lectures with interactive discussions,	

Quick Access

Physics (Master)
Qualification Awarded
Level of Qualification
Qualification Requirements and Regulations
Specific Admission Requirements
Recognition of Prior Learning
Profile of the Program
Program Key Learning Outcomes
Occupational Profile of Graduates
Access to Further Studies
Course Structure & Credits
Exam Regulations & Assessment & Grading
Graduation Requirements
Mode of Study
Programme Director(or Equivalent)
Evaluation Questionnaire
TYYÇ

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CONTRIBUTION OF COURSE LEARNING OUTCOMES TO PROGRAMME OUTCOMES
ECTS credits and course workload

		Homeworks, Applications	
3. Week	Green functions and their application	Oral lectures with interactive discussions, Homeworks, Applications	
4. Week	Particles in an external electromagnetic field, rigid body	Oral lectures with interactive discussions, Homeworks, Applications	
5. Week	Lorentz transformations, geometry of Minkowski space-time, rotational matrix, spacelike and timelike intervals, Lorentz contraction	Oral lectures with interactive discussions, Homeworks, Applications	
6. Week	Classical field theory, Gauge transformation	Oral lectures with interactive discussions, Homeworks, Applications	
7. Week	Relativistic wave equations, Klein-Gordon equation	Oral lectures with interactive discussions, Homeworks, Applications	
8. Week	Midterm exam	Written Exam	
9. Week	Dirac equation	Oral lectures with interactive discussions, Homeworks, Applications	
10. Week	Dirac equation for Fermion and their applications	Oral lectures with interactive discussions, Homeworks, Applications	
11. Week	Field quantization, nonrelativistic field theory	Oral lectures with interactive discussions, Homeworks, Applications	
12. Week	Perturbation theory, vacuum energy	Oral lectures with interactive discussions, Homeworks, Applications	
13. Week	Bose gas, Bose-Einstein condensation	Oral lectures with interactive discussions, Homeworks, Applications	
14. Week	Fermi gas	Oral lectures with interactive discussions, Homeworks, Applications	
15. Week	Degenerate electron gas	Oral lectures with interactive discussions, Homeworks, Applications	
16. Week	Final exam	Written exam	

RESOURCES

Recommended Sources
Quantum electrodynamics, V. B. Berestetskii, E. M. Lifshitz and Pitaevski, 2nd ed. Pergamon Press, Oxford, 1989
Quantum theory of many-particle systems, A.L. Fetter & W.D. Walecka
Greiner, Walter; Bromley, D.A.,Müller, Berndt. (2000). Gauge Theory of Weak Interactions. Springer.
Greiner, Walter; Bromley, D.A.,Müller, Berndt. (2000). Gauge Theory of Weak Interactions. Springer.

ASSESSMENT

Measurement and Evaluation Methods and Techniques
Mid-term exam + Assignment + Research & Project and Presentation 40%, Final Exam 60%

COURSE CATEGORY

Course Category	Percentage
Support Courses	% 100

CONTRIBUTION OF COURSE LEARNING OUTCOMES TO PROGRAMME OUTCOMES

Programme Outcomes	Contribution Level	DK1	DK2	DK3	DK4	DK5
PY1	4	3	4	4	5	4
PY2	4	4	4	4	3	3
PY3	5	5	5	5	4	4
PY4	4	4	4	4	5	5
PY5	4	4	4	4	3	3
PY6	4	4	4	4	4	4
PY7	4	4	4	3	5	5
PY8	4	4	4	4	3	3
PY9	4	4	3	4	3	5
PY10	4	3	4	3	5	5
PY11	4	3	3	4	4	4
PY12	3	3	3	3	4	4
PY13	4	4	4	3	4	3
PY14	5	5	4	5	4	4
PY15	4	4	4	4	3	3

*DK = Course's Contrubution.

	0	1	2	3	4	5
Level of contribution	None	Very Low	Low	Fair	High	Very High

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ECTS CREDITS AND COURSE WORKLOAD

Event	Quantity	Duration (Hour)	Total Workload (Hour)
Final Exam	1	3	3
Presentation/Seminar	1	5	5
Mid Term Exam Preparation	1	10	10
Class Hours (14 weeks)	14	3	42

Mid Term Exam 1	1	3	3
Final Exam Preparation	1	12	12
Further Study	14	6	84
Research&Project	3	8	24
Assignment 1	1	9	9
		Total Workload	192
		Total Workload / 25.5 (s)	7.53
		ECTS Credit of the Course	8