The University of Jordan

Accreditation & Quality Assurance Center

Course Syllabus

Course Name: Special Theory of Relativity

1	Course title	Special Theory of Relativity
2	Course number	0302360
3	Credit hours (theory, practical)	2
	Contact hours (theory, practical)	2
4	Prerequisites/corequisites	Classical Mechanics-1 (0302351)
5	Program title	B Sc Physics
6	Program code	0302
7	Awarding institution	The University of Jordan
8	Faculty	Science
9	Department	physics
10	Level of course	2nd year
11	Year of study and semester (s)	2017 first semester
12	Final Qualification	B. Sc. Physics
13	Other department (s) involved in teaching the course	
14	Language of Instruction	English
15	Date of production/revision	December 30 2017

16. Course Coordinator:

Office numbers, office hours, phone numbers, and email addresses should be listed.

Noureddine Chair, Sun Tue Thu 10-11,n.chairr@ju.edu.jo

17. Other instructors:

Office numbers, office hours, phone numbers, and email addresses should be listed.

None

18. Course Description:

As stated in the approved study plan.

Unification of space and time (space-time), inertial frames of reference, Lorentz transformation, length Contraction and time dilation, relativity of simultaneity, time travel, causality, unification of momentum and energy, transformation of mass and energy, preliminary introduction to curved space: general relativity.

19. Course aims and outcomes:

A- Aims:

1- To provide the student with a basic understanding of Special Relativity (SR), such that he/she has a grasp of the origins of time dilation, length contraction, mass variation with speed, relativisitic addition of velocities, equivalence of mass and energy, etc.
2- To train the students to solve basic problems in SR (such as collisions)
3- To provide the student with an understanding of the applications of SR in physics and other disciplines, such as in nuclear physics (binding energy in nuclei for example), high energy physics (particle creation and annihilation, etc), etc.

B- Intended Learning Outcomes (ILOs): Upon successful completion of this course students will be able to …

1) Understand observers, events, frames of reference, and differentiate between inertial and non-inertial frames.
2) Understand the difference between Newtonian and Galilean concepts of space and time.
3) Perform Galilean transformations between different inertial frames of reference.
4) Understand the Michelson-Morley experiment and its main result that the speed of light is isotropic in any given inertial frame.
5) Understand the experimental evidence for departures from Newtonain mechanics and Galilean relativity for speeds approaching the speed of light.
6) Understand the experimental evidence for the speed of light as an upper speed limit.
7) Be able to state the fundamental postulates of Special Relativity .
8) Understand qualitatively the distinction between covariance and invariance of physical quantities.
9) Be able to explain with a thought experiment the origin of the relativity of simultaneity
10) Be able to derive time dilation, length contraction, and other relativistic effects using light clocks and thought experiments. Derive Lorentz transformations. Be able to understand the new concept of spacetime.
11) Be able to perform velocity addition relativistically.
12) Be familiar with the concept of a space-time diagram and use it to solving elementary problems in special relativity.
13) Understand the four-vector construct and its use in relativistic calculations.
14) Understand the new relativistic formulations and know expressions for relativistic energy, momentum, mass, force and show their relationship to their Newtonian counterparts.
15) Be able to calculate energy and momentum of particles (including photons) in one frame given their values in another frame.
16) Understand that relativistic energy includes non-mechanical energy such as binding energy.
17) Solve elementary problems involving in two-body collisions using relativistic expressions for energy and momentum.

20. Topic Outline and Schedule:

Topic	Week	Instructor	Achieved ILOs	Evaluation Methods	Reference
Newtonian/Galilean relativity, Frames of Reference	1,2	Noureddine Chair	1,2,3	Quizzes, Homework, Discussions, Tests	As listed in the references section
Michelson-Morley Experiment, Experimental Evidence for departures from Galilean Relativity Same	2,3	Noureddine Chair	4,5,6	Same as above	

Dr. Khaled Bodoor					
Postulates of SR	3	Noureddine Chair	7	Same as above	
Thought Experiments and Mathematical Derivations of Time Dilation, Length Contraction, Mass Variation with Speed	4,5,6	Noureddine Chair	8,9,10,11	Same as above	
Four Vectors, Space-Time Diagrams, Relativistic Collisions	7,8,9	Noureddine Chair	12,13	Same as above	
Relativistic Dynamics	10,11,12	Noureddine Chair	14,15,16,17	Same as above	

21. Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

1- Use of a data projector to present the lecture material.
2- Use of pen and board to work out problems, show derivation details, draw diagrams, etc.
3- Engaging the students during class in thinking about the concepts and problems, including on calling on them to answer questions.
4- Asking students to work out problems on the board during class.
5- Assigning reading material from the internet.
6- Assigning homework.

22. Evaluation Methods and Course Requirements:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

1- Quizzes in class.
2- Assigned homework.
3- In class exams (midterm and final exams).
4- Asking students to volunteer to work out problems on the board during class.
5- Ask students questions during class.

23. Course Policies:

A- Attendance policies: Attendance is compulsory and

B- Absences from exams and handing in assignments on time: Students are urged to hand in homework on time and very late homework is not accepted.

C- Health and safety procedures:

D- Honesty policy regarding cheating, plagiarism, misbehavior:

E- Grading policy:

F- Available university services that support achievement in the course:

24. Required equipment:

25. References:

A- Required book (s), assigned reading and audio-visuals:

1) French, Anthony Philip. Special Relativity. New York, NY: Norton, 1968. ISBN: 9780393097931
2) Resnick, Robert. Introduction to Special Relativity. New York: Wiley, 1968. ISBN: 9780471717256

B- Recommended books, materials, and media:

26. Additional information:

Name of Course Coordinator: Noureddine Chair Signature: ---------- Date: ----December 30 2017-------- Head of curriculum committee/Department: ---------- Signature: ---------- ----------

Head of Department: ---------- Signature: ----------

Head of curriculum committee/Faculty: ---------- Signature: ----------

Dean: ---------- -Signature: ----------

Copy to:
Head of Department
Assistant Dean for Quality Assurance
Course File