Form: Course Syllabus		
	Form Number	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
	Number and Date of Revision or Modification	
	Deans Council Approval Decision Number	2/3/24/2023
	The Date of the Deans Council Approval Decision	23/01/2023
	Number of Pages	06

1.	**Course Title**	Theory of relativity
2.	**Course Number**	0302765
3.	**Credit Hours (Theory, Practical)**	3 theory
	Contact Hours (Theory, Practical)	3 theory
4.	**Prerequisites/ Corequisites**	No prerequisites
5.	**Program Title**	M.Sc. in Physics
6.	**Program Code**	
7.	**School/ Center**	Faculty of Science
8.	**Department**	Department of Physics
9.	**Course Level**	2nd year
10.	**Year of Study and Semester (s)**	Fall semester 2024/2025
11.	**Other Department(s) Involved in Teaching the Course**	
12.	**Main Learning Language**	English
13.	**Learning Types**	☐Face to face learning ☐Blended ☐Fully online
14.	**Online Platforms(s)**	☐Moodle ☐Microsoft Teams
15.	**Issuing Date**	October 2024
16.	**Revision Date**	December 2024

17. Course Coordinator:

Name: Dr. Noureddine Chair Contact hours: (10:00-12:00) Sunday, Tuesday, Thursday

Office number: 013 Phone number: 22023

Email: n.chair@ju.edu.jo

18. Other Instructors:

Name:
Office number:
Phone number:
Email:
Contact hours:
Name:
Office number:
Phone number:
Email:
Contact hours:

19. Course Description:

As stated in the approved study plan. Revision of Special Relativity and Lorentz transformation. Tensor Algebra; Integrals, Densities, Derivatives and Covariant Derivatives. The Notion of Parallel Transport; The Curvature Tensor. The Geodsics of an Affine Connection; The Law of Gravitation; Metric; Conservation Laws and Variational Principles in General Relativity.

20. Program Intended Learning Outcomes: (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

1. To be able to identify, formulate, and solve broadly defined technical or scientific problems by applying knowledge of mathematics and science and/or technical topics to areas relevant to the discipline.
2. To be able to formulate or design a scientific system, process, procedure or program to contribute achieving scientific desired needs.
3. To be able to develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.
4. To be able to communicate his/her scientific contributions effectively with a range of audiences.
5. To be able to recognize and demonstrate social, ethical and professional responsibilities and the impact of technical and/or scientific solutions in global economic, environmental, and societal contexts.
6. To be able to function effectively independently and on teams for establishing goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

21. Course Intended Learning Outcomes: (Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1. **Understand and Apply Lorentz Transformations:**
   - Demonstrate a comprehensive understanding of the principles of Special Relativity and Lorentz transformations.
   - Analyze physical phenomena using relativistic frameworks.
2. **Master Tensor Algebra:**
   - Utilize tensor algebra in various contexts, including integrals, densities, derivatives, and covariant derivatives.
   - Solve mathematical problems involving tensor calculus.
3. **Explore Parallel Transport and Curvature:**
   - Explain the concept of parallel transport and its significance in curved spacetime.
   - Derive and interpret the curvature tensor in the context of General Relativity.
4. **Analyze Geodesics and Affine Connections:**
   - Formulate and solve equations of geodesics using affine connections.
   - Relate geodesics to the motion of particles and light in curved spacetime.
5. **Understand the Law of Gravitation in General Relativity:**
   - Analyze the transition from Newtonian gravitation to the law of gravitation in General Relativity.
   - Apply the Einstein field equations to describe the gravitational interactions.
6. **Work with Metrics and Conservation Laws:**
   - Derive and interpret the spacetime metric for various physical systems.
   - Apply conservation laws in the context of General Relativity.
7. **Utilize Variational Principles:**
   - Employ variational principles to derive fundamental equations in General Relativity.
   - Understand the role of action principles in modern theoretical physics.

Course ILOs	The learning levels to be achieved					
	Remembering	Understanding	Applying	Analysing	evaluating	Creating
1	✓	✓				
2		✓	✓	✓		
3	✓	✓	✓			
4	✓	✓		✓		
5		✓	✓	✓	✓	
6		✓	✓	✓		✓
7		✓		✓	✓	

٢٢. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:

Program ILOs / Course ILOs	ILO (1)	ILO (2)	ILO (3)	ILO (4)	ILO (5)	ILO (6)
1	✓	✓				
2	✓	✓				
3	✓	✓				
4	✓	✓				
5	✓	✓				
6	✓	✓				
٧	✓	✓				

٢٣. Topic Outline and Schedule:

Week	Lecture	Topic	ILO/s Linked to the Topic	Learning Types (Face to Face/ Blended/ Fully Online)	Platform Used	Synchronous / Asynchronous Lecturing	Evaluation Methods	Learning Resources
1	1.1 1.2 1.3	Revision of Special Relativity and Lorentz transformation		Face to Face	Microsoft Teams	Synchronous **Lecturing**	First Exam, Midterm Exam, Final Exam	Introduction to General Relativity by John D. Walecka
2	2.1 2.2 2.3	Tensor Algebra; Integrals, Densities						
3	3.1 3.2 3.3	Derivatives and Covariant Derivatives						

4	4.1 4.2 4.3							
5	5.1 5.2 5.3	The Notion of Parallel Transport						
6	6.1 6.2 6.3	The Curvature Tensor						
7	7.1 7.2 7.3							
8	8.1 8.2 8.3	The Geodsics of an Affine Connection						
9	9.1 9.2 9.3							
10	10.1 10.2 10.3	The Law of Gravitation						
11	11.1 11.2 11.3							
12	12.1 12.2 12.3	Metric						
13	13.1 13.2 13.3							
14	14.1 14.2 14.3	Conservation Laws and Variational Principles in General Relativity.						
15	15.1 15.2 15.3							

24. Evaluation Methods:

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

Evaluation Activity	Mark	Topic(s)	ILO/s Linked to the Evaluation activity	Period (Week)	Platform
First Exam	٣0%	Revision of Special Relativity and Lorentz transformation Tensor Algebra; Integrals, Densities Derivatives and Covariant Derivatives	1,2	6	On campus
Second Exam	٣0%	The Notion of Parallel Transport The Curvature Tensor The Geodsics of an Affine Connection The Law of Gravitation	3,4,5	12	On campus
Final Exam	40%	All	1-7	16	On campus

٢٥. Course Requirements:

(e.g.: students should have a computer, internet connection, webcam, account on a specific software/platform…etc.):

N/A

٢٦. Course Policies:

A- Attendance policies: According to JU by-laws.

B- Absences from exams and submitting assignments on time: According to JU by-laws.

C- Health and safety procedures: N/A

D- Honesty policy regarding cheating, plagiarism, misbehavior: According to JU by-laws.

E- Grading policy: According to JU by-laws.

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

٢٧. References:

A- Required book(s), assigned reading and audio-visuals: Introduction to General Relativity by John D. Walecka B- Recommended books, materials, and media:

2٨. Additional information:

N/A

Name of the Instructor or the Course Coordinator: …… Noureddien Chair ……	Signature:	Date: 10/2024
Name of the Head of Quality Assurance Committee/ Department ……	Signature: ……..……	Date: ……..……
Name of the Head of Department ……	Signature: ……..……	Date: ……..……
Name of the Head of Quality Assurance Committee/ School or Center ……	Signature: ……..……	Date: ……..……
Name of the Dean or the Director ……	Signature: ……..……	Date: ……..……