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Mechanics and Special Theory of Relativity

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Revisions

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15 Jan 2025

Department/Centre/School proposing the course

Physics, Department of

L-T-P Structure and Credit

L-T-P Structure

L (Lecture)	T (Tutorial)	P (Practical)
2.0	1.0	0.0

Credit

3.0

Course Number

Course Prefix	Nature of the course	Level of the course (0-9)	Unique Identification Number (0-999)	Course Number
[PY] Physics, Department of	[L] Lecture courses	1	3	PYL1003

Non-graded Units

No

Course Status**BS for all UG programs**

Yes

GE for all UG programs

No

HS for all UG programs

No

ES for all UG programs

No

Open Category**Is the course available to all other UG programs as Open Category?**

No

Is the course available to all other PG programs as Open Category?

No

Grading Schema**Grading Schema**

Regular (A/A-/B/B-/C/C-/D/E/F/NP/NF)

Frequency of offering**Frequency of offering**

Either semester

Faculty**Faculty who will teach the course**

All Physics Faculty

Will the course require any visiting faculty?

No

Articulate the Course Learning Outcomes (CLO)

CLO Serial Number	CLO description	CLO Assessment Type	CLO Assessment Method	CLO Assessment Description	CLO Weight
CLO 1	Apply Newtonian mechanics with appropriate mathematical rigour and will be able to solve problems related to mechanics especially in rotational dynamics.	Examination	written/oral	Quizzes (Q), Assignment (A), Midterm & Endterms Exam (E)	Q&A (0-80%), E (0-100%)
CLO 2	Discuss the special theory of relativity.	Examination	written/oral	Quizzes (Q), Assignment (A), Midterm & Endterms Exam (E)	Q&A (0-80%), E (0-100%)

Add

Course Description**Course Contents**

Newton's equations of motion along with conservation laws. The central force motion along with different possible trajectories, followed by non-inertial frame of reference. Rigid-body dynamics. Michelson–Morley experiment, postulates of special theory of relativity and its consequences.

Target Audience

All UG students

Industry Relevance

NA

Map CLOs with PLOs**PLO to CLO Mapping**

CLO Serial Number	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
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CLO Serial Number	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CLO 1	2	3	2	2		
CLO 2	2	3	2	2		

Add

Indicate '1' for weak, '2' for good, and '3' for excellent relation. Leave the cell blank to indicate no relation. The Program Learning Outcomes (PLOs) are provided above.

Lecture Outline (with topics and number of lectures)

Module Serial Number	Module Topic	Number of hours	CLO Reference
Module 1	Introduction to different coordinate systems, position, velocity and acceleration in different coordinate systems	3.00	CLO 1
Module 2	Newton's laws of motion, Newton's law of gravity, free body diagrams.	3.00	CLO 1
Module 3	Central force motion of planetary bodies, Kepler's laws	5.00	CLO 1
Module 4	Rotational motion, angular momentum and torque, conservation laws, rotational dynamics, work energy theorem.	5.00	CLO 1
Module 5	Non-inertial frame of reference, fictitious forces	3.00	CLO 1
Module 6	Limitations of Newton's equation of motion, Michelson–Morley experiment, Galilean invariance and postulates of special theory of relativity,	4.00	CLO 3
Module 7	Lorentz transformation and inverse Lorentz transformation	2.00	CLO 3
Module 8	Simultaneity, length contraction and time dilation, relativistic Doppler effect, twin paradox, introduction to general relativity (principle of equivalence)	3.00	CLO 3

Add

Total Lecture Hours

28.00

Brief description of tutorial activities

Module Serial Number	Module Description	Number of hours	CLO Reference
Module 1	Introduction to different coordinate systems, position, velocity and acceleration in different coordinate systems	1.00	CLO 1
Module 2	Newton's laws of motion, Newton's law of gravity, free body diagrams.	1.00	CLO 1
Module 3	Central force motion of planetary bodies, Kepler's laws	2.00	CLO 1
Module 4	Rotational motion, angular momentum and torque, conservation laws, rotational dynamics, work energy theorem.	3.00	CLO 1
Module 5	Non-inertial frame of reference, fictitious forces	1.00	CLO 1
Module 6	Limitations of Newton's equations of motion, Michelson–Morley experiment, Galilean invariance and postulates of special theory of relativity	2.00	CLO 3
Module 7	Lorentz transformation and inverse Lorentz transformation	2.00	CLO 2
Module 8	Simultaneity, length contraction and time dilation, relativistic Doppler effect, twin paradox, introduction to general relativity (principle of equivalence)	2.00	CLO 2

Add

Total Tutorial Hours

14.00

Brief description of Practical / Practice activities

Module Serial Number	Module Description	Number of hours	CLO Reference
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Add

Self-learning Component

Module Serial Number	Module Description

Add

Suggested texts and reference materials

Author(s)	Title	Publisher/ Journal	Edition/ Volume (No)	Year
Kleppner D, and Kolenkow R.	An Introduction to Mechanics	Cambridge University Press	2	2014
Morin D	Introduction to Classical Mechanics with Problems and Solutions	Cambridge University Press	2	2008
R. Resnick	Introduction to Special Relativity	Wiley	1	2007
Beiser A.	Concepts of Modern Physics	Tata McGraw Hill	5	1995
Kittel C., Knight W. D., Ruderman M. A., Helmholz C. A. and Moyer B. J.	Mechanics (Berkeley Physics course)	McGraw Hill Education	2	2017

Add

Resources required for the course

Software

None

Hardware

None

Teaching aids (videos, etc.)

None

Laboratory

None

Equipment

None

Classroom infrastructure

Projector, White/Green/Digital board.

Site visits

None

Others (please specify)

NA

Design content of the course

Design-type problems

None

Open-ended problems

None

Project-type activity

None

Open-ended laboratory work

None

Others (please specify)

NA

Does this course satisfy any of the Institute Requirements (CEER, ETT, E&S)?

Creative Expression and Ethical Reasoning (CEER)

No

Emerging Trends and Technology (ETT)

No

Environment and Sustainability (E&S)

No

Does this course satisfy Communication, Professional Ethics or External Connect Requirements?

Communication

No

Professional Ethics

No

External Connect

No

Mapping with old course

Is this a newly designed course?

Yes

Submission Status

Submit to Faculty Board