NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF PHYSICS

COURSE PLAN – PART I			
Name of the programme and specialization	M. Sc - I Semester & Physics		
Course Title	CLASSICAL MECHANICS		
Course Code	PH653	No. of Credits	4
Course Code of Pre-requisite subject(s)	NIL		
0Session	July 2019	Section (if, applicable)	
Name of Faculty	Dr. Annapureddy Venkateswarlu	Department	Physics
Email	annp@nitt.edu	Telephone No.	0431-250-3603
Name of Course Coordinator(s) (if, applicable)	Dr. M.C. Santhosh Kumar		
E-mail	santhoshmc@nitt.edu	Telephone No.	0431-250-3611
Course Type	[√] Core course	[ ] Elective course	

Syllabus (approved in BoS)

Lagrangian

Formulation Mechanics of a system of particles – constraints – Lagrangian equation of motion from D'Alembert's and Hamilton's principles – conservation of linear momentum, energy and angular momentum – applications of the Lagrangian formalism.

Central Force Problem

Reduction to an one body problem – equation of motion and first integrals – one dimensional problems and classification of orbits – Kepler problem – scattering in a central potential – Rutherford formula – scattering cross section – transformation to laboratory frames.

Rigid Body and Oscillating System

Elements of rigid-body dynamics – Euler angles – symmetric top and applications – small oscillations – normal mode analysis – normal modes of a linear tri-atomic molecule – forced oscillations – effect of dissipative forces on free and forced oscillations – damped driven pendulum.

Hamiltonian Formulation

Legendre transformation – Hamiltonian equations of motion – cyclic coordinates – phase space and Liouville's theorem – Poisson brackets-Hamilton-Jacobi Theory – Action angle variables.

Special Theory of Relativity

Internal frames – principle and postulate of relativity – Lorentz transformations – length contraction, time dilation and the Doppler effect – velocity addition formula –relativistic invariance of physical laws.

COURSE OBJECTIVES

- ✓ To learn and use Newton's laws of motion to solve advanced problems involving the dynamic motion of classical mechanical systems.
- ✓ To introduce differential calculus and other advanced mathematical techniques pertaining to the development of Lagrangian and Hamiltonian formulations of classical mechanics.
- ✓ To solve the dynamical problems using conservation laws

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO) (Enter numbers only)
Students will be able to ✓ understand the advanced classical dynamical problems and find possible solutions for these problems. ✓ appreciate knowledge on special theory of relativity and their relative problems	

COURSE PLAN – PART II

COURSE OVERVIEW

- ✓ The CLASSICAL MECHANICS (Code: PH653) course is offered in the 1st-semester to all M.Sc Physics students.
- ✓ The subject has 4 credit theory weightage.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	Aug. 1st week	Introduction to classical mechanics- Newtonian Mechanics - Formulation Mechanics of a particle and a system of particles	Chalk & Talk, and Group Discussion (GD)
2	Aug. 2nd week	Constraints – Lagrangian equation of motion from D'Alembert's and Hamilton's principles	Chalk & Talk, GD
3	Aug. 3rd week	Conservation of linear momentum, energy and angular momentum, and Applications of the Lagrangian formalism	Chalk & Talk, GD

4	Aug. 4nd week	Applications of the Lagrangian formalism and problems solving practice	Chalk & Talk, GD, Flippled class
5	Aug. 5th week	Hamiltonian Formulation: Legendre transformation – Hamiltonian equations of motion	Chalk & Talk, GD
6	Sep. 1st week	cyclic coordinates – phase space and Liouville's theorem – Poisson brackets-	Chalk & Talk, GD
7	Sep. 2nd week	Hamilton-Jacobi Theory – Action angle variables and problems solving practice	Chalk & Talk, GD
8	Sep. 3rd week	Central Force Problem: Reduction to an one body problem – equation of motion and first integrals, One dimensional problems and	Chalk & Talk, GD
9	Sep. 4th week	classification of orbits-Kepler problem, scattering in a central potential – Rutherford formula -scattering cross section	Chalk & Talk, GD
10	Oct. 1st week	transformation to laboratory frames and problems solving practice	Chalk & Talk, GD
11	Oct. 2nd week	Rigid Body and Oscillating System Elements of rigid-body dynamics Euler angles – symmetric top and applications	Chalk & Talk, GD
12	Oct. 3rd week	small oscillations – normal mode analysis – normal modes of a linear tri-atomic molecule,	Chalk & Talk, GD
13	Oct. 4th week	forced oscillations effect of dissipative forces on free and forced oscillations – damped driven pendulum and problems solving practic	Chalk & Talk, GD
14	Oct. 5th week	Special Theory of Relativity Internal frames – principle and postulate of relativity – Lorentz transformations	Chalk & Talk, GD
15	Nov. 1st week	length contraction, time dilation and the Doppler effect and velocity addition formula	Chalk & Talk, GD
16	Nov. 2nd week	relativistic invariance of physical laws and problems solving practic	Flippled Class

COURSE ASSESSMENT METHODS (shall range from 4 to 6)				
S.No.	**Mode of Assessment**	**Week/Date**	**Duration**	**%Weightage**
1	**Assessment I**	Class performance and assignments	NA	10%
2	**Assessment II**	Sept. 3rd week	90 min	20%
3	**Assessment III**	Oct. 4th week	90 min	20%
CPA	**Compensation Assessment**	Nov. 1st week	90 min	20%
4	**Final Assessment**	Nov. 3rd/4th week	180 min	50 %
Total Theory				**100%**

ESSENTIAL READINGS : Textbooks, reference books, website addresses, journals, etc.

- H. Goldstein, C. Poole and J. Safko, Classical Mechanics, 3rd edition, Addison & Wesley (2000).
- W. Greiner, Classical Mechanics, Springer-Verlag (2003).
- W. Greiner, Classical Mechanics – Point particles and Relativity, Springer (1989).
- J. C. Upadhayaya, Classical Mechanics, Himalaya Publishing House (2014).
- D. Morin, Introduction to Classical Mechanics: With Problems and Solutions, Cambridge University Press (2008).
- N. C. Rana and P. S. Joag, Classical Mechanics, 25th edition, Mc Graw Hill India (2013).
- J. R. Taylor, Classical Mechanics, University Science Books (2005).
- *Concepts of Modern Physics,* Arthur Beiser, Tata McGraw-Hill, New Delhi (2010)

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

- ✓ Asking summary of each class at the end of class
- ✓ Performance in the assessment methods
- ✓ Questionnaire about the effectiveness of the delivery method, topics and the knowledge gained

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email/ phone etc)

- ✓ Both e-mail (annp@nitt.edu) and phone (0431-250-360)

COMPENSATION ASSESSMENT POLICY

- ✓ It is a test with duration of 90 minutes and 20% weightage only.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

  The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION

- ✓ Cell Phones should be turned-off in the classroom. During the lecture using mobile phones will be treated as punishable dishonesty.
- ✓ The teachers can be contacted through phone or in person for clarifications by the student on a mutually convenient time or through e-mail: annp@nitt.edu .
- ✓ The passing minimum shall be as per the regulations.

FOR APPROVAL

Course Faculty _____ CC-Chairperson _____ 16/9/2019 HOD _____ 16/9/2019