

COURSE TEMPLATE

1.	Department / Centre proposing the course	PHYSICS
2.	Course Title (<i>< 45 characters</i>)	ADVANCED MECHANICS AND THERMODYNAMICS
3.	L-T-P structure	3 - 0 - 0
4.	Credits	3
5.	Course number	PHL 114
6.	Status (<i>category for program</i>)	PROGRAM LINKED

7.	Pre-requisites (<i>course no./title</i>)	PHL 101
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	NO
8.2	Overlap with any UG/PG course of other Dept./Centre	NO
8.3	Supercedes any existing course	NA

9.	Not allowed for (<i>indicate program names</i>)	Engineering Physics
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10.	Frequency of offering	☒ Every sem ☐ 1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Dr. Santanu Ghosh, Dr. Sankalpa Ghosh, Dr. Varsha Banerjee, Prof. Ajit Kumar	
12.	Will the course require any visiting faculty?	NO

13.	Course objective (<i>about 50 words</i>): To provide knowledge of advanced mechanics (beyond Newtonian) in various physical systems. The dynamics of non-linear systems and analysis of fractional dimensions will be addressed. The course also offers fundamental understanding of laws of thermodynamics and application of thermodynamics in various thermal systems including nuclear reactors and heat exchangers.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Dynamics of a single and system of particles through energy approach, Hamilton's principle, the principle of least action, Canonical transformation, implication to mechanical systems, Poisson, bracket, Concepts of phase space, Liouville's theorem, principle of stochastic cooling. Concepts of non linear dynamics, contraction of phase space volume, attractors, classical chaos, periodic motion, chaotic trajectories, bifurcations, driven damped harmonic oscillator, fractals and dimensionalities, various examples of nature,	
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	transition from discrete to continuous systems and fields. Laws of thermodynamics, Carnot's cycle, adiabatic and isothermal processes, principle of ideal engine and refrigeration, Definition of entropy, enthalpy, free energy, Maxwell's relations, Concepts of transport of heat and mass, Heat diffusion equations with and without heat source in one and three dimension based on thermal circuit concepts, Applications in nuclear reactors and Fourier transform based analysis of heat exchange process.
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15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1	Dynamics of a single and system of particles through energy approach, Hamilton's principle, the principle of least action, Canonical transformation, implication to mechanical systems, Poission, bracket, Concepts of phase space, Lioville's theorem, principle of stochastic cooling.	12 hr lecture + 2 hr problem solving sessions
2	Concepts of non linear dynamics, contraction of phase space volume, attractors, classical chaos, periodic motion, chaotic trajectories, bifurcations, driven damped harmonic oscillator, fractals and dimensionalities, various examples of nature, transition from discrete to continuous systems and fields.	12 hr lecture + 2 hr problem solving sessions
3	Laws of thermodynamics, Carnot's cycle, adiabatic and isothermal processes, principle of ideal engine and refrigeration, Definition of entropy, enthalpy, free energy, Maxwell's relations, Concepts of transport of heat and mass, Heat diffusion equations with and without heat source in one and three dimension based on thermal circuit concepts, Applications in nuclear reactors and Fourier transform based analysis of heat exchange process.	12 hr lecture + 2 hr problem solving sessions
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COURSE TOTAL (14 times 'L')		42

16. Brief description of tutorial activities

Includes 6 hr of problem solving sessions.

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
1		
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COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. Classical Mechanics: System of particles and hamiltonian dynamics by W. Griener, Springer-Verlag
2. Engineering Thermodynamics, P. K. Nag, Tata Mc Graw Hill.
3. S. Glasstone and A. Sesnoske, Nuclear Reactor Engineering, D. Van Nostrand Company.
4. Classical Mechanics, H. Goldstein, C. Poole and J. Safko, Pearson Education Inc.

19. Resources required for the course (*itemized & student access requirements, if any*)

19.1	Software	NO
19.2	Hardware	NO
19.3	Teaching aides (videos, etc.)	LCD based Projection system
19.4	Laboratory	NO
19.5	Equipment	NO
19.6	Classroom infrastructure	No special infrastructure except LCD
19.7	Site visits	NO

20. Design content of the course (*Percent of student time with examples, if possible*)

20.1	Design-type problems	NO
20.2	Open-ended problems	Yes
20.3	Project-type activity	NO
20.4	Open-ended laboratory work	NO
20.5	Others (please specify)	NIL

Date: 28 January 2013

(Signature of the Head of the Department)