Department of Physics, Indian Institute of Technology Madras

Course Title	Classical Physics for Engineers	**Course No.**	PH350				
Department	Physics	**Structure**	2	1	0	3	
Offered for	Students opting for the minor stream ``Physics for Engineers''	**Status**	Core				
Faculty	Physics Faculty	**Type**	New				
Pre-requisite	None	**To take effect from**	01/07/07				

Submission date	**Date of approval by DCC**	**Date of approval by BAC**	**Date of approval by Senate**
14/03/07	14/03/07	16/03/07	

Objectives: This is the first course in the minor stream titled "Physics for Engineers". It introduces the students to aspects of classical mechanics, statistical physics and to elementary ideas in special relativity.

Course contents:

Dynamics in classical phase space: degrees of freedom, generalized coordinates and velocities, phase space and phase trajectories. Lagrangian formalism, Euler-Lagrange equations. Generalized momenta, Hamiltonian formulation. Periodic and non-periodic motion. Physics examples.

The need for statistical physics. Coarse-graining of phase space. Density of states for physical systems, examples. Microstates and macrostates. The concept of thermal equilibrium. Ensembles and ensemble averages.

Relationship between thermodynamics and statistical physics.

Ideal and real gases.

Phase transitions. Mean field theory of paramagnet-ferromagnet transition and solid-liquid-gas transitions.

Elementary aspects of special relativity. The principle and postulate of relativity. Lorentz transformations. Length contraction, time dilation. Addition of velocities. Four-vectors.

Symmetry, invariance and conservation principles. Importance of symmetries in physics. Discrete and continuous symmetries. Energy, momentum and angular momentum conservation. Charge conservation.

Text Books:

1. D.T. Greenwood, Classical Dynamics, Prentice-Hall, New Delhi,1985
2. W. Greiner, Classical Mechanics: Systems of Particles and Hamiltonian Dynamics, Springer-Verlag, New York, 2003.
3. L. N. Hand and J. D. Finch, Analytical Mechanics, Cambridge University Press, Cambridge, 1998.
4. F. Reif, Fundamentals of Statistical and Thermal Physics, McGraw-Hill International Student Edition, New York, 1988.
5. F. Mandl, Statistical Physics, 2nd edition, ELBS & Wiley, New York, 1988.
6. R. Resnick, Introduction to Special Relativity, Wiley Eastern, New Delhi, 1985.

References:

1. T. W. B. Kibble and F. H. Berkshire, Classical Mechanics, 5th edition, Imperial College Press, London, 2004.
2. D. Kleppner and R. J. Kolenkow, An Introduction to Mechanics, Tata McGraw-Hill, New Delhi, 1999.
3. S. T. Thornton and J. B. Marion, Classical Dynamics of Particles and Systems, Brooks Cole, 2003.
4. C. Kittel, Elementary Statistical Physics, Wiley, New York, 1966.
5. A. J. Walton, Three Phases of Matter, 2nd edition, Oxford University Press, Oxford, 1989.
6. J. M. Yeomans, Statistical Mechanics of Phase Transitions, Clarendon Press, Oxford, 1992.
7. W. Rindler, Introduction to Special Relativity, Oxford University Press, Oxford, 2004.
8. E. F. Taylor and J. A. Wheeler, Spacetime Physics, W. H. Freeman, San Francisco, 1992.
9. A. P. French, Special Relativity, W. W. Norton, 1968.