18BSP607					Introduction to Plasma Physics					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
					25	50	25	--	--	100

COURSE OBJECTIVES

- To understand the general properties of Plasma, the fourth state of matter.
- To understand the dynamics of a single particle of Plasma in static fields.
- To understand the dynamics of a single particle of Plasma in time varying fields.
- To introduce the properties of Plasma in terms of Boltzman equation and as a fluid.
- To introduce the basic concepts of magnetohydrodynamics.
- To introduce the techniques of Plasma production and applications.

UNIT 1 General Properties of Plasmas **7 Hrs.**

Criteria for the Definition of a Plasma, Macroscopic Neutrality, Debye Shielding, The Plasma Frequency, The Occurrence of Plasmas in Nature, Applications of Plasma Physics, Theoretical Description of Plasma Phenomena.

UNIT 2 Charged particle dynamics **13 Hrs.**

Charged particle dynamics in uniform electrostatic and magnetostatic fields, Charged particle dynamics in non-uniform magnetostatic fields, Charged particle dynamics in time varying electromagnetic fields.

UNIT 3 Introduction Plasma Kinetics and MHD **10 Hrs.**

The Boltzmann Equation, Relaxation Model for the Collision Term, The Vlasov Equation, Plasma as a Conducting Fluid, The Langevin Equation, Fundamental Equations of Magnetohydrodynamics.

UNIT 4 Plasma production and applications **10 Hrs.**

dc discharge, rf discharge, photo-ionization, tunnel ionization, avalanche breakdown, laser produced plasmas, Langmuir probe. Medium and short wave communication, plasma processing of materials, laser ablation, laser driven fusion, magnetic fusion.

Max. <40> Hrs.

COURSE OUTCOMES

On completion of the course, student will have the

CO1 – understanding of the general properties of Plasma, the fourth state of matter.

CO2 – Understanding of the dynamics of a single particle of Plasma in static fields

CO3 – Understanding of the dynamics of a single particle of Plasma in time varying fields

CO4 – knowledge of the properties of Plasma in terms of Boltzman equation and as a fluid

CO5 – knowledge of the basic concepts of magnetohydrodynamics

CO6 – knowledge of the techniques of Plasma production and applications

TEXT/REFERENCE BOOKS

1. Goldston, R. J., and P. H. Rutherford. *Introduction to Plasma Physics*. Philadelphia, PA: IOP Publishing, 1995.
2. J.A. Bittencourt, *Fundamentals of Plasma Physics, Springer, 2004*
3. *Krall, N. A., and A. W. Trivelpiece. Principles of Plasma Physics. Berkeley, CA: San Francisco Press,*
4. *Wesson, J. Tokamaks. 3rd ed. Oxford, UK: Oxford University Press, 2004*
5. *Stix, T. H. Waves in Plasmas. New York, NY: Springer, 1992.*
6. *Miyamoto, K. Plasma Physics for Nuclear Fusion. Cambridge, MA: MIT Press, 1989*

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Details> <> Marks

Part B/Question: <Details> <> Marks