Electrical Discharge and Plasma

a. Course Code:EPE-818

b. Title: Electrical Discharge and Plasma

c. Credit Hours: For each course=03

d. Objectives (Repetition: Same as educational objectives)

The objectives of "**Electrical Discharge and Plasma**" course are:

- To gain knowledge of basic processes in low-temperature weakly ionized discharge plasma
- To understand the fundamental properties of DC, RF, corona, and spark type of electric discharges in gases.
- To learn different simulation techniques for discharge plasma simulations
- To learn the use of "Multi-physics Software" for plasma discharge simulations
- To learn and analyze plasma discharge generation techniques for conducting research and development in electrical and other industries.

e. Outcomes

By the end of this course students will be able for following.

- Understand the core concepts of weakly ionized low-temperature plasma discharges
- Understand the series of different physical processes behind complete breakdown of different high voltage gaseous insulation
- Develop and design simulation models for plasma discharges through different numerical simulation techniques and Multiphysics software

f. Contents with suggested contact hours

The details of the content and contact hours

Sr. No.	Topics	Book	Contact Hours
1	**Introduction** • Subject of electrical discharge • History of electrical discharge research • Classification of electrical discharges • Subject of low temperature plasma • Interconnection of electrical discharge and plasma	Y.P.R	3
2	**Elementary processes Electrical Discharge** • Charged particles in plasma and electrical discharge • Motion of charged particles in electric and magnetic field • Collision interaction of charged particles • Ionization and deionization processes	MA	9
3	**High Voltage Discharge Plasma** • DC discharges • Pulsed DC discharges • Dielectric barrier discharge • High pressure discharges	DX	6
4	**Spark and corona discharges** • General concepts • Electron avalanches • Streamer discharge • Streamer initiation and propagation • Streamer in electronegative gases • Spark channel • Corona discharges	Y.P.R	9

	• Leader discharges		
5	**Capacitively coupled Radio-Frequency Discharges** • RF and microwave discharges • Capacitively coupled discharges • Inductively coupled discharges • Microwave discharges	Y.P.R	6
6	**Plasma Discharge Modelling and Numerical Simulation** • Theoretical foundation of plasma modelling • Fluid simulation Technique • Particle simulation technique • Hybrid simulation technique • Limitation in plasma modelling and numerical simulation	DX	6
7	**Gas discharge plasma and their applications** • Electrical power industry (SF_6 alternatives, CO_2 decomposition etc.) • Non-electrical industry (material, processing, medical treatment, water treatment, pollution treatment, waste management)	MA	6
Total			**45**

g. Details of lab work, and workshop practice (if applicable). N/A

h. Recommended Reading (including Textbooks and Reference books with dates).

S.	Title	Author(s)	Year	Codes	Remarks

No.			Published		
1	Plasma Physics and Engineering	A. Fridman and L. Kennedy	2011	A.F	Textbook
2	Gas Discharge and Gas Insulation	D. Xiao	2015	DX	Reference book
3	Gas Discharge Physics	Yu. P. Raizer	1997	Y.P	Text book
4	Fundamentals of Plasma Discharges and Materials Processing	M.A. Lieberman and A. Lichtenberg	2005	MA	Reference book

i. Assessments

Mid-term, Final Exam and quizzes, assignment etc.