22EEHO108	ADVANCED POWER SYSTEM PROTECTION	SEMESTER			
PREREQUISTIES	**CATEGORY**	**PEC**	**Credit**		**3**
Power systems protection	**Hours/Week**	**L**	**T**	**P**	**TH**
		3	**0**	**0**	**3**

Course Objectives:

1. Understand the concepts of advances in power system protection
2. Analyze digital protection of power system equipments
3. Design of protection relays

UNIT I	**NUMERICAL PROTECTION**	**9**	**0**	**0**	**9**

Introduction - Block diagram of numerical relay - Sampling theorem - Correlation with a reference wave - Least Error Squared (LES) technique - Digital filtering and numerical over- Current protection.

UNIT II	**DIGITAL PROTECTION OF TRANSMISSION LINE**	**9**	**0**	**0**	**9**

Introduction - Protection scheme of transmission line – Distance relays - Traveling wave relays - Digital protection scheme based upon fundamental signal - Hardware design - Software design - Digital protection of EHV/UHV transmission line based upon traveling wave phenomenon - New relaying scheme using amplitude comparison.

UNIT III	**DIGITAL PROTECTION OF SYNCHRONOUS GENERATOR & TRANSFORMER**	**9**	**0**	**0**	**9**

Introduction - Faults in synchronous generator - Protection schemes for Synchronous Generator - Digital protection of Synchronous Generator - Faults in a Transformer - Schemes used for Transformer Protection - Digital Protection of Transformer.

UNIT IV	**DISTANCE AND OVERCURRENT RELAY SETTING AND CO-ORDINATION**	**9**	**0**	**0**	**9**

Directional instantaneous IDMT over current relay - Directional multi-Zone distance relay - Distance relay setting - Co-ordination of distance relays - Co-ordination of over current relays - Computer graphics display - Man-machine interface subsystem - Integrated operation of national power system - Application of computer graphics.

UNIT V	**PC APPLICATIONS FOR DESIGNING PROTECTIVE RELAYING SCHEME**	**9**	**0**	**0**	**9**

Types of faults – Assumptions - Development of algorithm for SC studies - PC based integrated software for SC studies - Transformation to component quantities - SC studies of multiphase systems - Ultra high speed protective relays for high voltage long transmission line.

Total (45L+0T)= 45 Periods

Text Books:

1. L. P. Singh, "Digital Protection - Protective Relaying from Electromechanical to Microprocessor", New Age International Ltd., New Delhi, Second Edition, 2006
2. S. R. Bhide, “Digital Power System Protection”, Prentice Hall of India Pvt. Ltd., New Delhi, 2014
3. Paithankar and Bhide, “Fundamentals of Power System Protection”, Prentice Hall of India Pvt. Ltd., New Delhi, second edition, 2010.

Reference Books:

1. Paithankar, “Transmission Network Protection”, Marcel & Dekker, New York, 1998
2. Stanley Horowitz, “Protective Relaying for Power System II”, John Wiley & Sons, 2008.

E-Reference

1. https://nptel.ac.in/courses/108101039

Course Outcomes: Upon completion of this course, the students will be able to:			**Bloom's Taxonomy Mapped**
CO1	:	To understand the numeric protection	L2: Understanding
CO2	:	To design the digital protection of transmission line	L1: Applying
CO3	:	To design the digital protection of synchronous generator	L4: Analysing
CO4	:	To design the digital protection relays	L5: Evaluating
CO5	:	To study the pc based digital protection relays	L2: Understanding

COURSE ARTICULATION MATRIX

COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	1	1	1	1	1	1	1	1			1		1	1	1
CO2	1	3	3	2	2	1	2	1	1		1		1	1	1
CO3	1	2	2	2	2	1	2	1	1		1		1	1	1
CO4	1	3	2	2	2	1	2	1	1		1		1	1	1
CO5	1	2	3	2	2	1	2	1	1		1		1	1	1
Avg	1	2.2	2.2	1.8	1.8	1	1.8	1	1	0	1	0	1	1	1

3/2/1-indicates strength of correlation (3- High, 2-Medium, 1- Low)