GRID INSTRUMENTATION AND COMMUNICATION SYSTEMS

IIISemester: EPS							
Course Code	**Category**	\multicolumn{3}{c}{**Hours / Week**}	**Credits**	\multicolumn{3}{c}{**Maximum Marks**}

Course Code	**Category**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BPSC28	**Elective**	3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	\multicolumn{4}{l}{**Total Practical Classes: Nil**}	\multicolumn{3}{l}{**Total Classes: 45**}

I. COURSE OVERVIEW:

Smart Grid evolution is the need for fundamental changes in electrical grid technologies and their management This subject will help students to learn about enable enhanced grid operations with the help of the control and instrumentation arena. This course requires integration between the measurement, operations, control and IT systems to derive the necessary operational and business intelligence—thus making the grids smarter, safer, more efficient, and ever more resilient.

II. COURSE OBJECTIVES:

The students will try to learn:
I. Different grid instrumentation and communication.
II. Different learning algorithms and their applications to data analysis.
III.Monitoring, control, acquisition and information processing of power system data.
IV.The methods of information processing.

III. COURSE OUTCOMES:

CO 1	**Know** the digital voltage, frequency, time measurements and digital displays with A/D & D/A circuits operation along with their drawbacks.	Understand
CO 2	**Explore** data acquisition systems along with emergency and preventive control to know their importance.	Understand
CO 3	**Analyze** signal and system analyzers to know their application to data analysis.	Analyze
CO 4	**Illustrate** about PMU to know their application in computer control.	Understand
CO 5	**Interpret** the PLC programming languages to know their application in smart grid.	Understand
CO 6	**understand** SCADA components and its interfaces, security in smart grid.	Understand

IV.SYLLABUS

MODULE –I: DIGITAL INSTRUMENTATION (09)

Introduction, Basic measurement system. Digital voltage measurement, Frequency measurement, Time measurement, Digital phase meter, Digital multi-meter. Digital displays. A/D and D/A circuits and their operation, errors.

MODULE –II: ON-LINE COMPUTER CONTROL (09)

Distributed digital control. Data acquisition systems. Emergency control, preventive control, system wide optimization. Signal and system Analyzers. Time-error and inadvertent interchange correction techniques. system wide optimization. Introduction to PMUs, technology and their placement. Applications.

MODULE –III: COMPONENTS OF CONTROL SYSTEMS (09)

Components of control systems, supervisory control and Data acquisition PLC: Block diagram, programming languages, ladder diagram, functional block diagram, applications, SCADA systems: components of SCADA Systems, communication media, interfaces and security; SCADA in power

systems, Regional Grid and DCS based SCADA systems. interfacing of PLC with SCADA.

MODULE –IV: COMMUNICATION TECHNOLOGY FOR SMART GRID OPERATIO(09)
Analog vs digital communications, ISO/OSI layer model, Physical layer: power line carrier, wired, wireless, Protocols and interfaces: TCP/IP, Mbus, Field buses and remote communications.

MODULE –V: INFORMATION PROCESSING (09)
SCADA and DCS systems, Advance control methods. Distribution management systems. Data aggregation, data centres and clearing houses. Role of State Estimation. Fault detection and diagnosis. Dependability aspects. Cybersecurity aspects, Privacy aspects..

V. Text Books:
1. H S Kalsi, "Electronic Instrumentation", Tata Mc Graw Hill, 2010.
2. Mini S. Thomas, John D. McDonald, "Power System SCADA and smart grids", CRC Press, Taylor and Francis.

VI. Reference Books:
1. Hendrik c. Ferreira, et al, "Power Line Communication- Theory and Applications for narrow band and broad communication over power lines", Willy Publications.

VII. Web References:
1. https://intra.ece.ucr.edu/~hamed/Smart_Grid_Topic_3_Communications.pdf
2. https://www.slideshare.net/syedmustafablr/grid-computing-notes

VIII. E-Text Books:
1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118820216
2. https://books.google.co.uk/books/about/Grid_Enabled_Remote_Instrumentation.html?id=X3JnVa56ibAC&utm_source=gb-gplus-shareGrid