INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

GRID INSTRUMENTATION AND COMMUNICATION SYSTEMS								
III Semester: EPS								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BPSE28	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Power systems								

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:

CO1 Know the digital voltage, frequency, time measurements and digital displays with A/D & D/A circuits operation along with theirdrawbacks.
CO2 Explore data acquisition systems along with emergency andpreventive control to know their importance.
CO3 Analyze signal and system analyzers to know their application to dataanalysis.
CO4 Illustrate about PMU to know their application in computer control.
CO5 Interpret the PLC programming languages to know their applicationin smart grid.
CO6 Understand SCADA components and its interfaces, security in smart grid.

IV. COURSE CONTENT:

MODULE –I: DIGITAL INSTRUMENTATION (10)

Introduction, Basic measurement system. Digital voltage measurement, Frequency measurement, Time measurement, Digital phase meter, Digital multi-meter. Digital displays. A/D and D/A circuitsand 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 (10)

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 (10)

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. Cyber security 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 bandand broad communication over power lines”, Willy Publications.

VII. ELECTRONICS RESOURCES:

1. https://intra.ece.ucr.edu/~hamed/Smart_Grid_Topic_3_Communications.pdf
2. https://www.slideshare.net/syedmustafablr/grid-computing-notes
3. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118820216
4. https://books.google.co.uk/books/about/Grid_Enabled_Remote_Instrumentation.html?id=X3 JnVa 56ibAC&utm_source=gb-gplus-shareGrid

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech-talk topics

4. Definition and terminology
5. Assignments
6. Model question paper-I
7. Model question paper-II
8. Lecture notes
9. Power point presentations