ADVANCED MEASUREMENT SYSTEMS (404204)

Teaching Scheme
Lectures: 3 Hrs / week

Examination Scheme
In-semester Assessment:
Phase I: 30 Marks
End semester Examination:
Phase II: 70 Marks

Course Educational Objectives:

1. To learn about measurements and its relation with instrumentation system.
2. To familiarize with the concepts of design and measurement of electronic instrumentation.

Course Outcomes:

At the end of the course the student will be able to

1. Illustrate the concepts of signal integrity design issues, limitations of various measurement equipments.
2. Analyze various measuring techniques for various digital and analog signals
3. Compare different types of Measurement protocols.
4. Illustrate the concepts of design and measurements of microwave, virtual and digital instrumentation.

Unit I: **Signal Integrity:** [6 hrs]

Signal Integrity design Issues, Signal Integrity Testing Challenges and solutions**,** Electrical Validation and Debug with DPO/MSO Series Oscilloscopes and Arbitrary Waveform Generators

Unit II: **Hardware design and testing methods:** [6 hrs]

Logic analyzer, its architecture & operation and Use of logic analyzer, Spectrum analyser, Network analyzer, Oscilloscope, DSO trigger modes Examples using MSO Use & limitations of different types of analysis

Unit III: **Role of electronic measurements in Embedded Systems:** [7 hrs]

Design issues and role of electronic measurements for debugging in Automotive Electronics (ECU), Serial bus decode Test instruments for a variety of standards, including: USB, PCI Express, CAN/, I2C, Need of interfacing, interfacing techniques, interfacing of different displays including Graphic LCD (320X240), interfacing of input devices including touch screen etc, interfacing of output devices like thermal printer etc., embedded communication using CAN and Ethernet, RF modules, GSM modem for AT command study etc.

Unit IV: **Microwave Measurements:** [7 hrs]

Fundamental test set up for advanced radar systems and EMI EMC measurements. Microwave Enclosures, Hazards and Microwave Measurements and Computations Electromagnetic Compatibility, Detection of microwave power: measurement of microwave power bridge circuit using thermister & barraters. Theory & operation of barraters, direct reading barraters bridges. Measurement of wavelengths: single line cavity coupling system, frequency pulling by reactive load, Transmission cavity wave meter & reaction wave meter, measurement of VSWR, measurements of attenuation, free space attenuation.

Unit V: **Virtual Instrumentation:** [6 hrs]

Virtual Instrumentation, VISA (GPIB, VXI, PXI), SCPI coding. Test system development using Virtual Instrumentation, Software role in virtual Instrumentation, Hardware role in virtual instrumentation. Virtual Instrumentation and its application, modulation techniques: TDM, FDM, ASK, PSK, application of the same in instrumentation, Distortion analyzer, Logic analyzers. Case study of Lab View based Data acquisition system design.

Unit VI: **Digital Instrumentation:** [6 hrs]

Universal counter and its mode _ totalizing, frequency, period, time interval, ratio, measurement errors, application of counters for frequency meter, capacitance meter and timers, automation in digital instruments, ADC and DAC techniques, types, and their specifications, V to F converter, Sample and hold, analog multiplexer, data loggers.

Text Books:

1. H.S.Kalsi, "Electronics Instrumentation", Tata McGraw-Hill Education,3rd Edition 2010.

2. Das, "Microwave Engineering", Tata McGraw-Hill Education, 2nd Edition 2009

3.Gupta, "Virtual Instrumentation Using Labview", Tata McGraw-Hill Education, 2nd Edition, 2010.

References:

1. http://vlab.co.in/ -
2. http://in.tek.com - Application Notes by Tektronix
3. http://www.agilent.co.in - Application Notes by Agilent
4. Coombs "Hand Book for Electronic Measurements" McGraw-Hill, Inc., 2nd Edition.

List of Experiments:

Perform any eight experiments from the given list.

(Equipments Required: DSO, MSO, Logic Analyzer , Power Scope, Arbitrary signal generator)

1. Study and application of Universal counters
2. Study of DSO _ measurement of response time of relay using DSO
3. Study of MSO
4. Study of logic Analyser
5. Study and application of ADC 0809
6. Study and application of DAC 0808
7. Study of Arbitrary waveform generator
8. Program to demonstrate I2C Protocol.
9. Program to demonstrate CAN Protocol.
10. System building and simulation on Virtual Instrumentation
11. VSWR Measurement (Using Vmax / Vmin Method)