Course Code	Course Title	L	T	P	C
1152EC127	SOFTWARE DEFINED RADIO	3	0	0	3

a) Course Category

Program elective

b) Preamble

With the rapid emergence of new standards and protocols in wireless communication, many functions of traditional radio receivers are being implemented in software. This course provides an overview of software defined radio systems and the technologies necessary for their successful implementation.

c) Prerequisite

Communication Systems, Digital Communication

d) Related Courses

Internet of Things, Virtual Instrumentation

e) Course educational objectives

i) Give students a knowledge about the traditional hardware radio and software defined radio architectures
ii) Know about the various signal processing hardware components
iii) Know about the major software architecture choices, components and high level programming languages
iv) Understand the basics of designing antenna systems to accommodate the needs of a software defined radio

f) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the traditional hardware radio architecture and hardware used for signal processing. Discuss about the complexity, challenges and issues regarding the implementation of SDR.	K2
CO2	Describe the 2G radio and hybrid radio architectures. Explain the basic block diagram of software defined radio.	K2

CO3	Discuss in detail about the various signal processing hardware components	K2
CO4	Describe about different software standards for software radio. Discuss about the software design patterns	K2
CO5	Explain how software radio principles can be applied to smart antenna systems	K2

g)Correlation of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	-	-	-	-	L	-	-	-	-	-	L	-	-
CO2	L	L	L	-	-	-	-	-	-	-	-	-	-	-
CO3	L	-	-	-	-	-	-	-	-	-	-	M	-	-
CO4	L	L	L	-	L	-	-	-	-	-	-	-	-	-
CO5	L	-	-	-	M	-	-	L	-	-	L	L	L	-

h) Course Content

UNIT I INTRODUCTION TO SOFTWARE DEFINED RADIO 9

Introduction –Software Defined Radio –A Traditional Hardware Radio Architecture –Signal Processing Hardware History –Software Defined Radio Project Complexity- Challenges and issues regarding the implementation of SDR

UNIT II A BASIC SOFTWARE DEFINED RADIO ARCHITECTURE TRANSMISSION LINES 9

Introduction–2G Radio Architectures-Hybrid Radio Architecture-Basic Software Defined Radio Block Diagram-System Level Functioning Partitioning-Digital Frequency Conversion Partitioning

UNIT III SIGNAL PROCESSING HARDWARE COMPONENTS 9

Introduction-SDR Requirements for Processing Power-DSPs-DSP Devices-DSP Compilers-Reconfigurable Processors-Adaptive Computing Machine-FPGAs

UNIT IV SOFTWARE ARCHITECTURE AND COMPONENTS 9

Introduction-Major Software Architecture Choices –Hardware –Specific Software Architecture-Software Standards for Software Radio-Software Design Patterns-Component Choices-Real Time Operating Systems-

High Level Software Languages -Hardware Languages

UNIT V SMART ANTENNAS USING SOFTWARE RADIO **9**

Introduction-3G smart Antenna Requirements-Phased Antenna Array Theory-Using Software Radio Principles to Antenna Systems-Smart Antenna Architectures-Optimum Combining/ Adaptive Arrays-DOA Arrays-Beam Forming for CDMA-Downlink Beam Forming

Total 45 Hrs

i) Learning Resources

Text Books

1. Paul Burns, Software Defined Radio for 3G, Artech House, 2002.
2. Software Radio: A Modern Approach to Radio Engineering By Jeffrey H. Reed Pearson Education Low Price Edition

Reference Books

1. Ramesh Garg, "Analytical and Computational Methods in Electromagnetics" Artech House, 2008
2. Gupta. K.C and R. Garg, " Microstrip line and slot line" Artech House, Boston, 1996
3. RavenderGoyal, "Monolithic MIC; Technology & Design", Artech House, 1989
4. Robert Caverly, "CMOS RFIC Design Principles" Artech House, 2007.

Online Resource

1. http://morse.colorado.edu/sdr/
2. *http://gnuradio.org/*
3. http://openhpsdr.org/

Practical Aspects

The implementation will give experience in designing, building, and debugging a wireless system. Matlab or C++ can be used for USRP software defined radios.