SOFTWARE DEFINED RADIO
(Elective Subject)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>11B1WEC232</th>
<th>Semester</th>
<th>8th Semester, B. Tech (ECE)</th>
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</thead>
<tbody>
<tr>
<td>Credits</td>
<td>3</td>
<td>Contact Hours</td>
<td>L-3 , T-0, P-0</td>
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Course Objectives:

The objective of this course is to provide knowledge of fundamental and state-of-the-art concepts in software defined radio.

Course Outcomes:

1. An ability to make system-level decisions for software defined radio technology and products.
2. Understanding of analog RF components as front end block in implementation of SDR.
3. Knowledge of digital hardware architectures and understanding of developmental methods.
4. To design circuits at different multirate signaling technique for frequency conversion and sampling issues.
5. Knowledge of software development methods for embedded wireless systems.
6. Understanding of ADC and DAC technology.
7. An ability to implement smart antenna algorithms.
8. An ability to implement modern wireless system such as systems based on OFDM.

Prerequisites for this course:

Thorough knowledge of analog and digital communication systems, along with signal processing techniques such as spectrum estimation, digital filters, FFT techniques and multirate signal processing techniques.
<table>
<thead>
<tr>
<th>Unit</th>
<th>Topics</th>
<th>References (chapter no. from Text Book)</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>“Introduction to SDR”: The Need for Software Radios, What Is a Software Radio? Characteristics and Benefits of a software radio, Design principles of software radio.</td>
<td>Ch.1</td>
<td>4</td>
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<tr>
<td>2</td>
<td>“Radio frequency implementation Issues”: The purpose of the RF Front-End, Dynamic Range, The principal challenges of receiver design, RF receiver, Front-End Topologies, Enhanced flexibility of the RF chain with software radios, Importance of the components to overall performance, Transmitter architectures and their issues, Noise and Distortion in the RF chain.</td>
<td>Ch. 2 from Text Book #1 and Ch.4 from Text Book#4</td>
<td>6</td>
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<td>3</td>
<td>“Digital generation of signals”: Introduction ,Comparison of Direct Digital Synthesis(DDS) with analog signal synthesis, Approaches to direct digital synthesis, Analysis of spurious signals, Spurious components due to periodic jitter, Bandpass signal generation, Performance of direct digital synthesis, Hybrid DDS-PLL systems, Applications of DDS, Generation of random sequence, ROM compression techniques.</td>
<td>Ch .5 from Text Book#2</td>
<td>6</td>
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<td>4</td>
<td>“Multirate signal processing”: Introduction, Sample rate conversion principles, Polyphase filters, Digital filter banks, Timing recovery in digital receivers using multirate digital filters.</td>
<td>Ch. 3 from Text Book#1</td>
<td>3</td>
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<tr>
<td>5</td>
<td>“Analog to Digital and Digital to Analog conversion”: Parameter of ideal data converters, Parameters of practical data converters, Techniques to improve data converter performance, common ADC and DAC architectures.</td>
<td>Ch.5 from Text Book #5 and Ch. 7from Text Book #</td>
<td>5</td>
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<tr>
<td>6</td>
<td>“Smart Antennas”: Vector channel modeling, Benefits of smart antennas, Structures of beam forming systems, Smart antenna algorithms, Diversity and Space-Time adaptive signal</td>
<td>Ch. 6</td>
<td>5</td>
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</tbody>
</table>
processing (STAP), Algorithms for transmit STAP, Hardware implementation of smart antennas, Array calibration.

7  “Digital Hardware Choices”: Introduction, Key hardware elements, DSP Processors, FPGA, Trade-offs in using DSPs, FPGAs, and ASICs, Power management issues, Using a combination of DSPs FPGAs, and ASICs.  Ch.7 and Ch.6 from Text Book #2

8  “Object –oriented representation of radios and network resources”: Networks, Object-oriented programming, Object broker, Mobile application environments, Joint tactical radio system  Ch.8 3

9  “Case studies in software radio design”: Introduction and a Historical perspective, SPEAK easy, JRTS, Wireless information transfer system, SDR-3000 digital transceiver subsystem, Spectrum wave, CHARIOT.  Ch.9 4

Total Number of Lectures 40

Evaluation Scheme: (100 Marks)

Mid Term Exam : 30 Marks  Final Term : 45 Marks
Internal Assessment: 25Marks  (Two Class Tests (Each carries -: 2.5 M) 5 Marks +  Five Assignments (Each carries -4 Marks): 20)

Text Books:


Reference Books:


Web Resources:
