NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	M.Tech COMMUNICATION SYSTEMS		
Course Title	Cognitive Radio		
Course Code	EC664	No. of Credits	3
Course Code of Pre-requisite subject(s)			
Session	January 2019	Section (if, applicable)	
Name of Faculty	Yamini.T.M	Department	ECE
Official Email	yaminitm@nitt.edu	Telephone No.	8056177794
Name of Course Coordinator(s) (if, applicable)			
Official E-mail		Telephone No.	
Course Type (please tick appropriately)	✓ Elective course	T	Core course

Syllabus (approved in BoS)

Filter banks-uniform filter bank. Direct and DFT approaches. Introduction to ADSL Modem. Discrete multitone modulation and its realization using DFT. QMF. STFT. Computation of DWT using filter banks.

DDFS- ROM LUT approach. Spurious signals, jitter. Computation of special functions using CORDIC. Vector and rotation mode of CORDIC.CORDIC architectures.

Block diagram of a software radio. Digital down converters and demodulators Universal modulator and demodulator using CORDIC. Incoherent demodulation - digital approach for I and Q generation, special sampling schemes. CIC filters. Residue number system and high speed filters using RNS. Down conversion using discrete Hilbert transform. Under sampling receivers, Coherent demodulation schemes.

Concept of Cognitive Radio, Benefits of Using SDR, Problems Faced by SDR, Cognitive Networks, Cognitive Radio Architecture. Cognitive Radio Design, Cognitive Engine Design.

A Basic OFDM System Model, OFDM based cognitive radio, Cognitive OFDM Systems, MIMO channel estimation, Multi-band OFDM, MIMO-OFDM synchronization and frequency offset estimation. Spectrum sensing to detect Specific Primary System, Spectrum Sensing for Cognitive OFDMA Systems.

Text Book
1. M.J.S. Smith : Application Specific Integrated Circuits, Pearson, 2003

2. *Sudeep Pasricha and NikilDutt, On-Chip Communication Architectures System on Chip Interconnect, Elsevier, 2008*

Reference Books

1. *H.Gerez, Algorithms for VLSI Design Automation, John Wiley, 1999*
2. *Jan.M.Rabaey et al, Digital Integrated Circuit Design Perspective (2/e), PHI 2003*
3. *David A.Hodges, Analysis and Design of Digital Integrated Circuits (3/e), MGH 2004*
4. *Hoi-Jun Yoo, Kangmin Leeand Jun Kyong Kim, Low-Power NoC for High-Performance SoC Design, CRC Press, 2008*
5. *An Integrated Formal Verification solution DSM sign-off market trends, www.cadence.com.*
6. *Recent literature in Design of ASICs*

COURSE OBJECTIVES

This subject introduces the fundamentals of multi rate signal processing and cognitive radio.

MAPPING OF COs with POs

Course Outcomes	Programme Outcomes (PO)
1. Gain knowledge on multirate systems	PO1,PO2,PO4,PO11
2. Develop the ability to analyze, design, and implement any application using FPGA	PO1,PO2,PO4,PO11
3. Be aware of how signal processing concepts can be used for efficient FPGA based system design	PO4,PO11, PO12
4. Understand the rapid advances in Cognitive radio technologies	PO4, PO6, PO11, PO12
5. Explore DDFS, CORDIC and its application	PO4, PO6, PO11, PO12

COURSE PLAN – PART II

COURSE OVERVIEW

Students get exposure to the concepts of Cognitive and Software Defined Radio. Students will be taught of principle of operation and applications of several cognitive radio techniques and devices. Students will understand the QMF, DDFS, CORDIC, SDR, MIMO, OFDM concepts. Further they will be exposed to spectrum sensing and Cognitive OFDM systems.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	2nd week of January 3 Contact hours	Filter banks-uniform filter bank. Direct and DFT approaches.	Lecture, C&T/PPT or any suitable mode.

2	3rd week of January 3 Contact hours	Introduction to ADSL Modem. Discrete multitone modulation and its realization using DFT.	Lecture, C&T/PPT or any suitable mode.
3	4th week of January 3 Contact hours	QMF. STFT. Computation of DWT using filter banks.	Lecture, C&T/PPT or any suitable mode.
4	1st week of February 3 Contact hours	Tutorial and practice problems.	Lecture, C&T/PPT or any suitable mode.
5	2nd week of February 3 Contact hours	DDFS- ROM LUT approach. Spurious signals, jitter.	Lecture, C&T/PPT or any suitable mode.
6	3rd week of February 3 Contact hours	Computation of special functions using CORDIC. Vector and rotation mode of CORDIC.CORDIC architectures.	Lecture, C&T/PPT or any suitable mode.
7	4th week of February 3 Contact hours	Block diagram of a software radio. Digital down converters and demodulators Universal modulator and demodulator using CORDIC.	Lecture, C&T/PPT or any suitable mode.
8	1st week of March 3 Contact hours	Incoherent demodulation - digital approach for I and Q generation, special sampling schemes. CIC filters. Residue number system and high speed filters using RNS.	Lecture, C&T/PPT or any suitable mode.
9	2nd week of March 3 Contact hours	Down conversion using discrete Hilbert transform. Under sampling receivers, Coherent demodulation schemes.	Lecture, C&T/PPT or any suitable mode.
10	3rd week of March 3 Contact hours	Concept of Cognitive Radio, Benefits of Using SDR, Problems Faced by SDR, Cognitive Networks.	Lecture, C&T/PPT or any suitable mode.
11	4th week of March 3 Contact hours	Cognitive Radio Architecture. Cognitive Radio Design, Cognitive Engine Design.	Lecture, C&T/PPT or any suitable mode.
12	1st week of April 3 Contact hours	A Basic OFDM System Model, OFDM based cognitive radio, Cognitive OFDM Systems.	Lecture, C&T/PPT or any suitable mode.
13	2nd week of April 3 Contact hours	MIMO channel estimation, Multi-band OFDM, MIMO-OFDM synchronization and frequency offset estimation.	Lecture, C&T/PPT or any suitable mode.

14	3rd week of April 3 Contact hours	Spectrum sensing to detect Specific Primary System, Spectrum Sensing for Cognitive OFDMA Systems.	Lecture, C&T/PPT or any suitable mode.

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment 1	3rd week of February	60 minutes	20
2	Assessment 2	4th week of March	60 minutes	20
3	Assignments/Seminars	1st and 2nd weeks of April		10
CPA	Compensation Assessment	3rd week of April	60 minutes	20
5	Final Assessment	1st week of May	180 minutes	50

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Feedback from the students during class committee meetings.

Anonymous feedback through questionnaire.

COURSE POLICY

MODE OF CORRESPONDENCE (email/ phone etc)

➢ All the students are advised to check their NITT WEBMAIL/group mail/suggested by the course faculty, class representative regularly. All the correspondence (schedule of classes/ schedule of assessment/ course material/ any other information regarding this course) will be done through them only.
➢ Queries (if required) to the course teacher shall only be emailed to the email id specified by the teacher.

COMPENSATION ASSESSMENT POLICY

➢ Valid reasons for student's absence in either or both of the assessments would be taken for consideration of Compensation Assessment.
➢ Improvement in marks will not be considered a criterion for compensation assessment.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

➢ At least 75% attendance in each course is mandatory.

- A maximum of 10% shall be allowed under On Duty (OD) category.

- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.

- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.

- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

FOR APPROVAL

Course Faculty _____ CC- Chairperson _____ HOD _____

(B. REBEKKA)