

DEPARTMENT OF ELECTRONICS AND COMMUNICATION
ENGINEERING

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NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	COGNITIVE RADIO		
Course Code	ECPE12	No. of Credits	03
Course Code of Pre-requisite subject(s)	--		
Session	January 2020	Section (if, applicable)	--
Name of Faculty	Ashish Patil	ECE Department	B.Tech (ECE)
Email	ash11etc@gmail.com	Telephone No.	8147185954
Name of Course Coordinator	-		
E-mail	--	Telephone No.	--
Course Type	PE		
Syllabus (approved in BoS)			
<ul style="list-style-type: none"> 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. 			
COURSE OBJECTIVES			
<ul style="list-style-type: none"> To introduce the fundamentals of multi rate signal processing and cognitive radio. To make the students to analyze and develop cognitive radio based application. 			
COURSE OUTCOMES (CO)			
Students are able to			
<ol style="list-style-type: none"> Gain knowledge on multirate systems. Develop the ability to analyze, design, and implement any application 			

- using multirate concepts.
3. Be aware of how signal processing concepts can be used for cognitive communication systems.
 4. Understand the rapid advances in Cognitive radio technologies.
 5. Explore DDFS, CORDIC and its application.

COURSE OUTCOMES	Aligned Programme Outcomes (PO)
1. Gain knowledge on multirate systems.	PO2, PO 7, PO 9, PO 13
2. Develop the ability to analyze, design, and implement any application using multirate concepts.	PO 3, PO 8
3. Be aware of how signal processing concepts can be used for cognitive communication systems.	PO 2, PO 3, PO 8, PO 14
4. Understand the rapid advances in Cognitive radio technologies.	PO 2, PO 3, PO 8, PO 10, PO 14
5. Explore DDFS, CORDIC and its application.	PO 4, PO 8

COURSE PLAN – PART II

COURSE OVERVIEW

This course provides the knowledge about fundamentals of multi rate signal processing and cognitive radio. Students will be able to analyze and develop cognitive radio based application. It will also help students to explore about DDFS and CORDIC applications.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No	Week/Contact Hours	Topic	Mode of Delivery
1.	Week 1 (3 Contact Hours)	Filter banks-uniform filter bank, QMF, direct and DFT approaches.	Lecture C&T
2.	Week 2 (3 Contact Hours)	Introduction to ADSL Modem. Discrete multitone modulation and its realization using DFT	Lecture C&T / PPT
3.	Week 3 (3 Contact Hours)	DDFS- ROM LUT approach. Spurious signals, jitter	Lecture C&T / PPT
ASSESSMENT I - 5 Marks			
4.	Week 4 (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
5.	Week 5	ASSESSMENT II - 20 Marks	Descriptive / Numerical (Written)
6.	Week 6 (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
7.	Week 7	Incoherent demodulation - digital approach for I and Q generation,	Lecture

	(3 Contact Hours)	special sampling schemes. CIC filters.	C&T / PPT or any suitable mode	
8.	Week 8 (3 Contact Hours)	Residue number system and high speed filters using RNS. Down conversion using discrete Hilbert transform. Under sampling receivers, Coherent demodulation schemes.	Lecture C&T/ PPT or any suitable mode	
ASSESSMENT III - 5 Marks				
9.	Week 9 (3 Contact Hours)	Concept of Cognitive Radio, Benefits of Using SDR, Problems Faced by SDR	Lecture C&T/ PPT or any suitable mode	
10.	Week 10	ASSESSMENT IV - 20 Marks		Descriptive / Numerical (Written)
11.	Week 11 (3 Contact Hours)	Cognitive Networks, Cognitive Radio Architecture. Cognitive Radio Design, Cognitive Engine Design	Lecture C&T/ PPT or any suitable mode	
12.	Week 12 (3 Contact Hours)	A Basic OFDM System Model, OFDM based cognitive radio, Cognitive OFDM Systems	Lecture C&T/ PPT or any suitable mode	
13.	Week 13 (3 Contact Hours)	MIMO channel estimation, Multi-band OFDM, MIMO-OFDM synchronization and frequency offset estimation	C&T/ PPT or any suitable mode	
14.	Week 14 (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				
S.No	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment I	1 st week Feb		5
2	Assessment II (CT I)	3 rd Week Feb	60 Minutes	20
3	Assessment III	2 nd Week of March		5
4	Assessment IV (CT II)	4 th Week of March	60 Minutes	20
5	Assessment V (CPA)	1 st Week of April	60 Minutes	20
6	End Assessment	4 th Week of April	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 (preferred mode of correspondence with students, policy on attendance, compensation assessment, academic honesty and plagiarism etc.)

CORRESPONDENCE

1. 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.
2. Queries (if required) to the course teacher shall only be emailed to the email id specified by the teacher.

ATTENDANCE

3. Attendance will be taken by the faculty in all the contact hours. Every student should try to be present in the class during these contact hours.
4. Those students who missed any of the continuous assessments (CAs) due to genuine reasons can appear for retest. The scores in the retest will be taken into account for computing marks for CA.

ASSESSMENT

5. Attending all the assessments are MANDATORY for every student.
6. Every student is expected to score ~~minimum 40% of the maximum mark of the class in the total assessment~~ (1, 2, 3, 4 and 6) to pass the course. Otherwise the student would be declared fail and 'F' grade will be awarded. Further he can take up only FORMATIVE ASSESSMENT.

marks as per institute norms

ACADEMIC HONESTY & PLAGIARISM

1. All the students are expected to be genuine during the course work. Taking of information by means of copying simulations, assignments, looking or attempting to look at another student's paper or bringing and using study material in any form for copying during any Assessments are considered dishonest.
2. Tendering of information such as giving one's program, simulation work, assignments to another student to use or copy is also considered dishonest.
3. Preventing or hampering other students from pursuing their academic activities is also considered as academic dishonesty.
4. Any evidence of such academic dishonesty will result in the loss of marks on that assessment. Additionally, the names of those students so penalized will be reported to the class committee chairperson and HoD of the concerned department.
5. Students who honestly producing ORIGINAL and OUTSTANDING WORK will be REWARDED.

ADDITIONAL INFORMATION

FOR APPROVAL

Course Faculty *[Signature]*

CC-Chairperson *[Signature]*

HOD *[Signature]*

Mrs. Archis Patel.

(Dr. V. Sudha)