

**NATIONAL INSTITUTE OF TECHNOLOGY,  
TIRUCHIRAPPALLI**

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

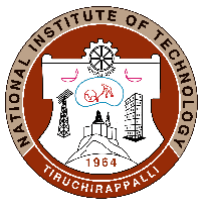
COURSE PLAN – PART I			
<b>Name of the programme and specialization</b>	<b>M.Tech Communication Systems</b>		
<b>Course Title</b>	<b>Cognitive Radio</b>		
<b>Course Code</b>	<b>EC664</b>	<b>No. of Credits</b>	<b>3</b>
<b>Course Code of Pre-requisite subject(s)</b>			
<b>Session</b>	<b>July 2021</b>	<b>Section (if, applicable)</b>	
<b>Name of Faculty</b>	<b>Dr. P.Sudharsan</b>	<b>Department</b>	<b>ECE</b>
<b>Official Email</b>	<b>sudharsan@nitt.edu</b>	<b>Telephone No.</b>	
<b>Name of Course Coordinator(s) (if, applicable)</b>			
<b>Official E-mail</b>		<b>Telephone No.</b>	
<b>Course Type (please tick appropriately)</b>	<b>PE</b>		
<b>Syllabus (approved in BoS)</b>			
<p>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 filterbanks.</p> <p>DDFS- ROM LUT approach. Spurious signals, jitter. Computation of special functions using CORDIC. Vector and rotation mode of CORDIC.CORDICarchitectures.</p> <p>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.</p> <p>Concept of Cognitive Radio, Benefits of Using SDR, Problems Faced by SDR, Cognitive Networks, Cognitive Radio Architecture. Cognitive Radio Design, Cognitive EngineDesign,</p> <p>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 OFDMASystems</p>			
<b>COURSE OBJECTIVES</b>			
This subject introduces the fundamentals of multi rate signal processing and cognitive radio.			
<b>MAPPING OF COs with POs</b>			



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<b>Course Outcomes</b>	<b>Programme Outcomes (PO) (Enter Numbers only)</b>
CO1: gain knowledge on multirate systems	1, 2, 3,12
CO2: develop the ability to analyze, design, and implement any application using FPGA.	1, 2, 3,12
CO3: be aware of how signal processing concepts can be used for efficient FPGA based system design.	1, 2, 3,12
CO4: : understand the rapid advances in Cognitive radio technologies.	1, 2, 3,12
CO5: Explore DDFS, Cordic and its application	1, 2, 3,12

<b>COURSE PLAN – PART II</b>			
<b>COURSE OVERVIEW</b>			
The aim of this course is that students should understand the fundamentals of multi rate signal processing and cognitive radio.			
<b>COURSE TEACHING AND LEARNING ACTIVITIES</b>			( Add more rows)
<b>S.No.</b>	<b>Week/Contact Hours</b>	<b>Topic</b>	<b>Mode of Delivery</b>
1	1 <sup>st</sup>	Filter banks-uniform filter bank. direct and DFT approaches	PPT
2	2 <sup>nd</sup>	Introduction to ADSL Modem. Discrete multitone modulation and its realization using DFT	PPT
3	3 <sup>rd</sup>	STFT.Computation of DWT using filterbanks.	PPT
4	4 <sup>th</sup>	DDFS- ROM LUT approach. Spurious signals, jitter. Computation of special functions using CORDIC.	PPT
5	5 <sup>th</sup>	Vector and rotation mode of CORDIC.CORDIC architectures. representation,	PPT
6	6 <sup>th</sup>	Block diagram of a software radio. Digital down converters and demodulators Universal modulator and demodulator using CORDIC	PPT



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7	7 <sup>th</sup>	Incoherent demodulation - digital approach for I and Q generation, special sampling schemes.	PPT
8	8 <sup>th</sup>	CIC filters. Residue number system and high speed filters using RNS.	PPT
9	9 <sup>th</sup>	Down conversion using discrete Hilbert transform. Under sampling receivers, Coherent demodulation schemes.	PPT
10	10 <sup>th</sup>	Concept of Cognitive Radio, Benefits of Using SDR, Problems Faced by SDR	PPT
11	11 <sup>th</sup>	Cognitive Networks, Cognitive Radio Architecture. Cognitive Radio Design, Cognitive Engine Design	PPT
12	12 <sup>th</sup>	A Basic OFDM System Model, OFDM based cognitive radio, Cognitive OFDM Systems	PPT
13	13 <sup>th</sup>	MIMO channel estimation, Multi-band OFDM ,MIMO-OFDM synchronization	PPT
14	14 <sup>th</sup>	Frequency offset estimation ,Spectrum Sensing to detect Specific Primary System	PPT
15	15 <sup>th</sup>	Spectrum Sensing for Cognitive OFDMA Systems	PPT

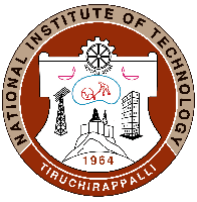
### **COURSE ASSESSMENT METHODS** (shall range from 4 to 6)

<b>S.No.</b>	<b>Mode of Assessment</b>	<b>Week/Date</b>	<b>Duration</b>	<b>% Weightage</b>
1	ASSESSMENT I Descriptive Type Examination (2 Units)	Fifth week	60 minutes	25
2	ASSESSMENT II Descriptive Type Exam (2 units)	Tenth week	60 minutes	25
3	Assessment III Descriptive Type Exam (1 unit)	Fifteenth week	60 minutes	20



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CPA	Compensation Assessment*		60 minutes	
4	FINAL ASSESSMENT *	End of the semester	120 minutes	30
*mandatory; refer to guidelines on page 4				
<b>COURSE EXIT SURVEY</b> (mention the ways in which the feedback about the course shall be assessed)				
1. Feedback from students through MIS.				
<b>COURSE POLICY</b> (including compensation assessment to be specified)				
<b><u>COMPENSATION ASSESSMENT</u></b>				
<ul style="list-style-type: none"> <li>➤ Attending all the assessments is MANDATORY for every student.</li> <li>➤ If any student is not able to attend any one of the internal assessments due to genuine reason, student will be permitted to attend the compensation assessment (CPA).</li> <li>➤ If a student has missed more than 1 internal assessment, then he/she will be allowed to appear only for one assessment with minimum weightage among the missed ones.</li> <li>➤ At any case, CPA will not be considered as an improvement test.</li> </ul>				
<b><u>ATTENDANCE POLICY</u></b> (A uniform attendance policy as specified below shall be followed)				
<ul style="list-style-type: none"> <li>➤ At least 75% attendance in each course is mandatory.</li> <li>➤ A maximum of 10% shall be allowed under On Duty (OD) category.</li> <li>➤ Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.</li> </ul>				
<b><u>ACADEMIC DISHONESTY &amp; PLAGIARISM</u></b>				
<ul style="list-style-type: none"> <li>➤ Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.</li> <li>➤ Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.</li> <li>➤ 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.</li> <li>➤ The above policy against academic dishonesty shall be applicable for all the programmes.</li> </ul>				



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**ADDITIONAL INFORMATION, IF ANY**

Students may fix appointments for detailed discussion by sending email to [sudharsan@nitt.edu](mailto:sudharsan@nitt.edu) two days prior to the desired appointments date with the topic to discuss. Minor doubts will be clarified after the contact hours without any prior appointment.

**FOR APPROVAL**

Course Faculty



CC- Chairperson



HOD



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## Guidelines

- a) The number of assessments for any theory course shall range from 4 to 6.
- b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.
- c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.
- d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

- e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.
- f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.
- g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.