

NPTEL Syllabus Template

Course Title	IC Design for Wireless Systems
Discipline	EE
Duration of course 4/8/12 weeks (10/20/30 hours @2.5 hrs/week)	12 weeks
Number of times you have taught this course totally and in the last 5 years (2-3 times is preferable, if not more)	4 times
Is this course syllabus approved by AICTE or by Senate in your/any institute? If yes, please give the course name and institute under which this is approved.	Yes, a similar course syllabus is approved by IIT Hyderabad senate. EE5192: Integrated Circuits for Wireless Communication
The time frame of when you would want to offer the course: (Jan 2024/July 2024)	Jan 2024
Will it map to any course in the AICTE model curriculum? LINK to AICTE Curriculum LINK 1 LINK 2 LINK 3 LINK 4	Minor overlap with the following courses: ECEL01: Microwave Theory and Techniques ECEL11: Mixed Signal Design
Will it map onto any of the NPTEL domain? LINK to Domain page: https://nptel.ac.in/noc/Domain/	VLSI Design

Name of the Instructor(s)	Abhishek Kumar	
Department	Electrical Engineering	
Institute	IIT Hyderabad	
Email ID	akumar@ee.iith.ac.in	
Mobile Phone Number	8056035492	
Website of Instructor	https://people.iith.ac.in/akumar/	

Intended audience	Final year UG, first year PG
Is it a core/elective course?	Elective
Is it a UG/PG/PhD level course?	Final year UG, first year PG, PhD
Is this course relevant for GATE exam preparation?	Yes
Which degrees would it apply to? (BE/ME/MS/BSc/MSc/PhD etc)	BE/ME/MS/PhD
What are the next set of courses that can be taken by students who complete this?	Students will be able to take advanced analog, RF, mixed-signal circuits and systems courses.
Pre-requisites in terms of educational qualification of participants, or if any other courses should be done before this course can be taken	Analog circuits, signal and systems
Industry recognition of this course – List of companies/industry that will recognize/value this online course	Qualcomm, Renesas, TI, Silicon Labs, Analog devices and other IC design companies in wireless systems domain.
Will the final certification exam be– paper/pen type or computer based - both are proctored	Computer
Will the course require use of any software such as MATLAB or any programming language, etc. or any other tool? If yes, does it have a Linux based compiler available or if licensed, can we get the educational license for the same?	No licensed software will be needed for this course.
Names of 2 reviewers for the course (can be from other institutes – will be used if we need any additional inputs on the course) – Name, Dept, email id, Institute	Name : <u>Prof. Sankaran Aniruddhan</u>
	Dept. : <u>Electrical Engineering</u>
	Institute : <u>IIT Madras</u>
	Email : <u>ani@ee.iitm.ac.in</u>
	Name : <u>Prof. Nagendra Krishnapura</u>
	Dept. : <u>Electrical Engineering</u>
	Institute : <u>IIT Madras</u>
	Email : <u>nagendra@ee.iitm.ac.in</u>
List of reference materials/books	[1] B. Razavi, RF Microelectronics, 2 edition. Upper Saddle River, NJ: Prentice Hall, 2011. [2] T. H. Lee, The Design of CMOS Radio-Frequency Integrated Circuits, Second Edition, 2 edition. Cambridge, UK; New York: Cambridge University Press, 2003. [3] S. Voinigescu, High-Frequency Integrated Circuits, 1st edition. Cambridge: Cambridge University Press, 2013. [4] D. M. Pozar, Microwave Engineering, 4 edition. Hoboken, NJ: Wiley, 2011.

	[5] Recent research papers.
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FOR GETTING THE INTRODUCTORY COURSE PAGE READY – TO OPEN FOR ENROLLMENTS

1. Introduce the course in about 4-5 lines

The course will focus on CMOS IC level implementation of RF, analog and mixed signal processing blocks used in a wireless system. Students will be able to develop intuition and mental models for designing transistor level high frequency circuits on an IC. Recent circuit techniques like N-path, noise-cancellation, digital power-amplifier etc. will be introduced during the course. The course will conclude with a case study of a practical transceiver design in a generic CMOS technology.

2. Photograph of instructor(s)



3. About the instructor(s)

Abhishek Kumar received the M.E. degree in microelectronics from the Indian Institute of Science Bangalore, India, in 2011, and the Ph.D. degree from IIT Madras, India, in 2018. He completed a five-month internship at Qualcomm India Pvt., Ltd., Bengaluru, in 2014, where he designed VCO for cellular transceiver IC. He is currently an Assistant Professor with IIT Hyderabad, India. His research interest includes radio frequency circuit design.

4. An introductory video about the course (2-5 minutes' duration)

Weekly Course Plan		
Weeks	Lecture Names	Assignments
Week1	Transceiver architecture: frequency translation, filtering, image	Online
Week2	Distributed circuits: transmission-lines basics, S-parameters, matching	Online
Week3	Electrical noise, noise-figure, linearity, compression, inter-modulation	Online
Week4	Receiver design: LNA; input matching, low noise, gain	Online
Week5	Receiver design: mixer, channel-selection	Online
Week6	Receiver design: embedding N-path filtering, noise cancellation	Online
Week7	Transmitter design: power amplifier, efficiency, spectral leakage	Online
Week8	Transmitter design: driver amplifier, power mixer	Online
Week9	Transmitter design: RF DAC, digital power amplifier, out-phasing	Online
Week10	Frequency synthesiser: VCO, PLL	Online
Week11	Frequency synthesiser: PLL based modulation and demodulation	Online
Week12	Case-study: WiFi transceiver example	Online

TA Details			
	:	Teaching Assistant 1	Teaching Assistant 2
Name	:	H S Trinath Tammiseti	Devesh Kumar
Department	:	Electrical Engineering	Electrical Engineering
Email ID	:	ee20resch11003@iith.ac.in	ee22mtech12001@iith.ac.in
Mobile Number	:		
Currently pursuing degree	:	PhD	M.Tech. (By research)