Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, Apr/May 2024

ELECTRONICS AND COMMUNICATION ENGINEERING

EC5006 RF MICROELECTRONICS

(Regulation 2019)

Time: 3hrs Max.Marks: 100

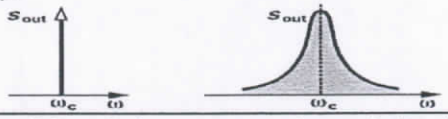
CO 1	Translate the top level wireless communications system specifications into block level specifications of the RF transceiver.
CO 2	Carry out transistor level design of the entire RF transceiver.
CO 3	Design and analyze CMOS LNAs , mixers, oscillators, PLL's, synthesizers and power amplifiers.

BL – Bloom's Taxonomy Levels

(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1	Two amplifiers with power gains A1 and A2 and Noise Factors F1 and F2 respectively are cascaded. Give the Friis formula for the Noise Factor of cascade of amplifiers.	2	CO1	L5
2	Give the Thevinin and Norton equivalents of the thermal noise generated by a resistor.	2	CO1	L1
3	Explain why mixers are used in RF receivers	2	CO2	L2
4	Give the block diagram of a typical heterodyne receiver.	2	CO2	L4
5	What do you understand by f_t of a MOSFET transistor.	2	CO3	L2
6	Explain any one problem that arises due to nonlinearity of amplifiers.	2	CO3	L4
7	Two possible LO output spectra are shown below. Which one is more desirable and why. 	2	CO1	L5
8	Give the definition of Q and give an expression relating bandwidth and Q	2	CO2	L2
9	Briefly explain any one important application of a PLL	2	CO3	L2
10	Explain briefly the conditions necessary for any feedback system to oscillate	2	CO2	L2

PART- B (5 x 13 = 65 Marks)

(Restrict to a maximum of 2 subdivisions)

Q. No	Questions	Marks	CO	BL
11 (a) (i)	Distinguish clearly between heterodyne and homodyne (direct conversion) receivers with necessary block diagrams and equations. State one advantage and one disadvantage of each of these. Distinguish between high side LO and low side LO in receivers	13	CO1	L2
	OR			
11 (b) (i)	With the help of suitable diagrams, explain what are meant by (i) input P1dB compression point and (ii) IIP3 and OPI3 associated with an amplifier. On what do these quantities depend. What could be the possible ideal values for these. What is meant by a two tone test	13	CO1	L2
12 (a) (i)	Two amplifiers with power gains A1 and A2 and Noise Factors F1 and F2 respectively are cascaded. Give the Friis formula for the Noise Factor of cascade of amplifiers. Give the general expression Noise Factor for the cascade of 'n' stages of such amplifiers.	13	CO2	L3

	OR			
12 (b) (i)	Give the noise equivalent circuit of a MOSFET along with the relevant expressions and explain the terms involved.	**7**	CO2	L3
(ii)	Give the circuit diagram of any one Low Noise Amplifier based on MOSFET and explain its operation	**6**		
13 (a)	Define what is meant by conversion gain of a mixer. Give the transistor circuit diagram of any one RF mixer and explain its operation.	**4+9**	CO2	L2
	OR			
13 (b) (i)	Explian the principle and operation of a simple multiplier based mixer and derive the expression for conversion gain.	**7+6**	CO2	L2
14 (a) (i)	Explain the role of a phase detector in PLL? Draw the circuit diagram of any one phase detector and explain its operation.	**5+8**		L4
	OR			
14 (b)	Draw the block diagram of any one PLL synthesizer and explain its operation. Give the relevant frequebcy transfer equations	**7+6**	CO3	L4
15 (a)	Explain the difference between Class A, ClassB and Class C operations of power amplifiers with the help suitable waveforms	**13**	CO2	L3
	OR			
15 (b)	Draw the ciruit diagram of any one switching power amplifier and explain its operation.	**13**	CO2	L3

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q. No	Questions	Marks	CO	BL
16. (i)	Draw the circuit diagram of any one LC ocilator and explain its operation.	**8**	CO3	L2
16 .(ii)	Draw the circuit diagram of any one L impedance matching circuit and explain its operation.	**7**