University of Mumbai

Examinations Summer 2022

Time: 2 hour 30 minutes Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks [20]
1	In RF receiver application the preamplifier has
Option A	Maximum gain amplifier
Option B	Low noise amplifier
Option C	Specific gain amplifier
Option D	Class A power amplifier
2	To design a maximally flat low pass filter with fc= 2 GHz ,impedance of 50 Ω and atleast 15 dB IL at 3 GHz the order N is
Option A	2
Option B	3
Option C	5
Option D	6
3	-------- is a technique a technique that reduces or prevents coupling of undesired radiated electromagnetic energy into equipment to enable it to operator compatibility in its electromagnetic environment .
Option A	Filtering
Option B	Grounding
Option C	Shielding
Option D	Bonding
4	Direct digital frequency synthesis is obtained by solving digital recursion relationship using a general purpose computer or--------.
Option A	Direct frequency synthesis
Option B	A PLL-DDFS combination
Option C	Multiple loop indirect synthesis
Option D	Sorting sine waves in look up table
5	Inductor is replaced with -------- and capacitor is replaced with ---------- of $\lambda/8$ line in Richard's transformation.
Option A	Short stub and open stub
Option B	Shunt capacitor and series indctor
Option C	Shunt inductor and series capacitor
Option D	Series Capacitor and series inductor
6	How instability can be created in oscillator design ?
Option A	Using capacitor in feedback
Option B	Using positive feedback
Option C	Using negative feedback
Option D	Using feed forward feedback
7	------ is not a EMC standard ,
Option A	CJNU FM
Option B	CISPR

Option C	MIL- STD 461 D
Option D	VDE
8	The maximum unilateral gain is a function of ---------.
Option A	Source reflection coefficient
Option B	S parameters of transistors
Option C	Load reflection coefficient
Option D	Source and load reflection coefficients
9	Select one which is not a method of frequency synthesis,
Option A	Frequency synthesis by modulus divider
Option B	Direct frequency synthesis
Option C	Compressed frequency synthesis
Option D	Frequency synthesis by PLL
10	Is it possible to use normal smith chart for reading input impedance for reflection coefficient greater than one
Option A	Only possible for certain values of reflection coefficient
Option B	Possible
Option C	Not possible
Option D	Possible if magnitude of reflection coefficient is less than 5

Q.2	
A	Solve any two 5 marks each
i	Draw one port oscillator circuit.Find value of R_L which maximizes oscillator power .
ii	Draw two port amplifier .Define various gains with equations.
iii	Describe single balanced mixer using 90^0 hybrid coupler with neat diagram.
B	Solve any one 10 marks each
i	A GaAs FET has the following scattering and noise parameters at 4 Ghz measured with 50 Ω system $S_{11} = 0.6 \angle -60^0$ $S_{12} = 0.05 \angle -26^0$, $S_{21} = 1.9 \angle 81^0$, $S_{22} = 0.5 \angle -60^0$,Fmin=1.6dB, Rn = 20 Ω and Γ opt $= 0.62 \angle 100^0$ Assuming the FET to be unilateral .design an amplifier for maximum possible gain and noise figure not more than 2dB.
ii	Design a composite low pass filter by image parameter method for following specifications $R_o = 50\ \Omega$ f_c=50 MHz. f_∞ = 52 MHz

Q3	
A	Solve any two 5 marks each
i	Compare design difference in amplifier and oscillator.
ii	Explain the characteristics of power amplifier,
iii	Explain the terms insertion loss, shape factor, quality factor ,rejection in filter.
B	Solve any one 10 marks each
i	Design a two port transistor oscillator at 6 GHz using FET in common source configuration driving 50 Ωload ondrain sideS_{11} = 0.9 ∠-150^0, S_{12} = 0.2 ∠-15^0 , S_{21} =2.6 ∠ 50^0 , S_{22} =0.5∠ -105 ^{0} .Calculate and plot stabilitycircles and choose Γt for Γin>> 1.Design load terminating network
ii	An N= 3 Chybyshev bandpass filter is to be designed with 3 dB passband ripple for a communication link The centre frequency is at 2.4 GHz and filter has to meet bandwidth requirement of 20% .The filter has to be inserted into 50 Ωcharacteristicline impedance

Q4	
A	Solve any two 5 marks each
i	What are the sources of EMI and effects of EMI,
ii	Explain differential FET mixer with diagram.
iii	Write a note on safety grounding.
B	Solve any one 10 marks each
i	S parameters of properly biased HFET-1101 measured using 50 Ωnetwork analyzer at 6 GHz S_{11} = 0.6 14∠-167.4^0,S_{12} = 0.046 ∠65^0, S_{21}=2.18∠ 32.4^0, S_{22} =0.716∠ -83^0 Design an amplifier using this for maximum possible gain
ii	A one port oscillator uses a negative resistance diode having Γin =1.25 ∠40 Zo=50 Ωat its desired operating point for f= 6GHz .Design load matching network.

Datasheet

TABLE 8.3 Element Values for Maximally Flat Low-Pass Filter Prototypes ($g_0 = 1$, $\omega_c = 1$, $N = 1$ to 10)

N	g_1	g_2	g_3	g_4	g_5	g_6	g_7	g_8	g_9	g_{10}	g_{11}
1	2.0000	1.0000									
2	1.4142	1.4142	1.0000								
3	1.0000	2.0000	1.0000	1.0000							
4	0.7654	1.8478	1.8478	0.7654	1.0000						
5	0.6180	1.6180	2.0000	1.6180	0.6180	1.0000					
6	0.5176	1.4142	1.9318	1.9318	1.4142	0.5176	1.0000				
7	0.4450	1.2470	1.8019	2.0000	1.8019	1.2470	0.4450	1.0000			
8	0.3902	1.1111	1.6629	1.9615	1.9615	1.6629	1.1111	0.3902	1.0000		
9	0.3473	1.0000	1.5321	1.8794	2.0000	1.8794	1.5321	1.0000	0.3473	1.0000	
10	0.3129	0.9080	1.4142	1.7820	1.9754	1.9754	1.7820	1.4142	0.9080	0.3129	1.0000

Source: Reprinted from G. L. Matthaei, L. Young, and E. M. T. Jones, *Microwave Filters, Impedance-Matching Networks, and Coupling Structures*, Artech House, Dedham, Mass., 1980, with permission.

TABLE 8.4 Element Values for Equal-Ripple Low-Pass Filter Prototypes ($g_0 = 1$, $\omega_c = 1$, $N = 1$ to 10, 0.5 dB and 3.0 dB ripple)

0.5 dB Ripple

N	g_1	g_2	g_3	g_4	g_5	g_6	g_7	g_8	g_9	g_{10}	g_{11}
1	0.6986	1.0000									
2	1.4029	0.7071	1.9841								
3	1.5963	1.0967	1.5963	1.0000							
4	1.6703	1.1926	2.3661	0.8419	1.9841						
5	1.7058	1.2296	2.5408	1.2296	1.7058	1.0000					
6	1.7254	1.2479	2.6064	1.3137	2.4758	0.8696	1.9841				
7	1.7372	1.2583	2.6381	1.3444	2.6381	1.2583	1.7372	1.0000			
8	1.7451	1.2647	2.6564	1.3590	2.6964	1.3389	2.5093	0.8796	1.9841		
9	1.7504	1.2690	2.6678	1.3673	2.7239	1.3673	2.6678	1.2690	1.7504	1.0000	
10	1.7543	1.2721	2.6754	1.3725	2.7392	1.3806	2.7231	1.3485	2.5239	0.8842	1.9841

3.0 dB Ripple

N	g_1	g_2	g_3	g_4	g_5	g_6	g_7	g_8	g_9	g_{10}	g_{11}
1	1.9953	1.0000									
2	3.1013	0.5339	5.8095								
3	3.3487	0.7117	3.3487	1.0000							
4	3.4389	0.7483	4.3471	0.5920	5.8095						
5	3.4817	0.7618	4.5381	0.7618	3.4817	1.0000					
6	3.5045	0.7685	4.6061	0.7929	4.4641	0.6033	5.8095				
7	3.5182	0.7723	4.6386	0.8039	4.6386	0.7723	3.5182	1.0000			
8	3.5277	0.7745	4.6575	0.8089	4.6990	0.8018	4.4990	0.6073	5.8095		
9	3.5340	0.7760	4.6692	0.8118	4.7272	0.8118	4.6692	0.7760	3.5340	1.0000	
10	3.5384	0.7771	4.6768	0.8136	4.7425	0.8164	4.7260	0.8051	4.5142	0.6091	5.8095

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