

B.E. ELECTRONICS & TELE-COMMUNICATION ENGINEERING
4th YEAR, 2nd SEMESTER (Old) - 2017

MONOLITHIC MICROWAVE INTEGRATED CIRCUITS

Time: Three hours

Full Marks:100

Answer any five questions.

1. a) What is Hybrid MIC? Compare MMIC with Hybrid MIC. [2+2]
 b) Write the design procedure of the following components for MMIC: i) resistor, ii) small value inductor, iii) large value inductor, iv) series capacitor, v) parallel capacitor and vi) Lange coupler. Discuss Via-holes and grounding techniques for MMIC. [2+2+2+2+2+2+4]
2. What are the main differences between voltage divider and attenuator? Design a -6 dB T-attenuator for 50 Ohm system and discuss regarding its operational bandwidth. Draw the schematic diagram of a balanced analog attenuator and discuss its working principle. What is digital attenuator? Explain operation of switched bridged T attenuator. [2+6+6+1+5]
3. Explain the use of PIN diode as microwave switch for directing signal or power flow between components or sub-circuits. Using circuit diagrams discuss on i) single-pole series and ii) single-pole shunt PIN diode switches. How can high isolation switches be obtained using FET? Draw the schematic diagram of a FET SPDT switch and explain its operation. [3+5+5+2+5]
4. Using a simple single loop mixer explain the effect of non linear device on mixed signal for different input signal and LO. What is conversion loss? What is isolation? What are the differences between single balanced diode mixer and double balanced mixer? Draw schematic diagram of double-balanced resistive FET mixer and explain its working principle. Why BALUN is required for this type of mixer? [5+2+2+3+6+2]
5. What are the uses of phase shifters? Draw the schematic diagram of a switched line phase shifter consists of microstrip lines and PIN diodes and explain its operation. Explain the design principle of a loaded line 45° phase shifter at 12 GHz? Explain operations of switched filter phase shifters. [2+5+8+5]
6. a) Draw a two-port transistor amplifier network with general source and load impedances and define source, load, input and output reflection coefficients (Γ_s , Γ_L , Γ_{in} and Γ_{out}). Write the differences between power gain G , available gain G_A , transducer power gain G_T and unilateral transducer power gain G_{TU} ? [4+4]
 b) Design an amplifier with maximum G_{TU} using a transistor with the following scattering parameters ($Z_0 = 50$ Ohm) at 6.0 GHz: $S_{11} = 0.61 \angle -170^\circ$, $S_{12} = 0$, $S_{21} = 2.24 \angle 32^\circ$, and $S_{22} = 0.72 \angle -83^\circ$. Design L-section matching sections using lumped elements. [12]

[Turn over

7. Write short notes on (any four):

[4x5=20]

- i) Wilkinson power splitter/combiner
- ii) Analog reflection type attenuator
- iii) Microstrip line and CPW
- iv) Microstrip implementation of single ended FET mixer
- v) Microstrip implementation of single ended diode mixer