Student Exam No ____

GANPAT UNIVERSITY

M.Tech Semester –II (EC) Regular Examination, April-June 2016

(3EC 205 –[1]) RF Circuits and Systems

Max. Time: 3 Hrs.] [Max. Marks: 60

Instructions:

1. Attempt **all** questions.
2. Answers to the **two** sections must be written in **separate** answer books.
3. Figures to the **right** indicate full marks.
4. **Assume** suitable data, if necessary.

SECTION-I

Q-1 (A) A silicon bipolar junction transistor has the following scattering parameters at GHz, with a 50 Ω reference impedance: 5

$S_{11} = 0.38\angle -158^\circ$,
$S_{12} = 0.11 \angle 54^\circ$,
$S_{21} = 3.50\angle 80^\circ$,
$S_{22} = 0.40\angle -43^\circ$

The source impedance is $Z_S = 25\ \Omega$ and the load impedance is $Z_L = 40\ \Omega$. Compute the power gain, the available power gain, and the transducer power gain.

(B) What do you mean by Unconditional stability concept in amplifier design? Derive the equation for the output stability circle for microwave amplifier design. 5

OR

Q-1 (A) What do you mean by conditional stability concept in amplifier design? Derive required equations for the input stability circle for microwave amplifier design. 5

(B) What is Nyquist or Barkhausen criterion for oscillator functioning? Derive basic equations for design of Colpitt oscillator based on CE configuration using general analysis method for it. 5

Q-2 (A) Discuss in detail about Double balanced mixers. 5

(B) Write short note on Dielectric resonator oscillators. 5

OR

Q-2 (A) Explain about working of single ended mixers with suitable diagrams. 5

(B) What is importance of phase noise in oscillator design? Discuss about it in detail. 5

Q-3 (A) Write short notes on Microwave sensors. 3

(B) Draw basic block diagram of ROF based system and explain functionality of its each block. 3

(C) Write short note on Microwave Radiometer. 4

SECTION - II

Q-4 (A) With help of Planck's blackbody radiation law derive equation for power of thermal noise. What you will say about ultraviolet catastrophe condition with reference to it? 5

(B) Derive equation for Noise Figure and effective noise temperature of a three stage cascaded system. 5

OR

Q-4 (A) Discuss in detail about Measurement of Noise Temperature (Y factor) method. 5

(B) Briefly discuss about tests for unconditional stability for amplifier design procedure. 5

Q-5 (A) A receiver has a noise figure of 7 dB, a 1 dB compression point of 25 dBm (referenced to output), a gain of 40 dB, and a third-order intercept point of 35 dBm (referenced to output). If the receiver is fed with an antenna having a noise temperature of $T_A = 150^\circ$ K, and the desired output SNR is 10 dB, find values of linear and spurious free dynamic ranges and give your comment form those values. Assume a receiver bandwidth of 100 MHz. 5

(B) Write short note on Single-pole PIN diode switches. 5

OR

Q-5 (A) An X-band amplifier has a gain of 20 dB and a 1 GHz bandwidth. Its equivalent noise temperature is to be measured via the Y-factor method. The following data are obtained: 5
For $T_1 = 290$ K, $N_1 = -62.0$ dBm.
For $T_2 = 77$ K, $N_2 = -64.7$ dBm.
Determine the equivalent noise temperature of the amplifier. If the amplifier is used with a source having an equivalent noise temperature of $Ts = 450^\circ$ K, what is the output noise power from the amplifier, in dBm?

(B) With required equations describe about low noise amplifier design issue. 5

Q-6 (A) Explain concept of the Third-order intercept point for a nonlinear component working. 3

(B) Discuss briefly about Broadband high power and multistage Amplifiers. 3

(C) Derive required equation for Noise Figure of a Passive Two-Port Network. 4

END OF PAPER