key 110 ab

Seat No. ☐

King Mongkut University Of Technology Thonburi

Midterm Examination Semester 1/2017

Subject : EIE 326 Electronics Communication Engineering

Student: 3rd Yr. Electronics & Telecommunication Eng.

Date: October 2nd, 2016 Time: 09.00-12.00PM

Instructions

1. There are 50 questions (101 points) in 10 pages. The formulas are included in the last page.
2. Answer all question in these papers.
3. KMUTT approved calculator can be used.
4. No documents allowed
5. You are not allowed to bring the question papers out of the examination room.

Notes

- When finish, raise your hand for the permission to leave the room.
- Any misbehave in this room may result to the highest penalty

Name _____ Student ID _____

Assistant Prof. Chanin Wongngamkam Tel: 9070

This papers have been approved

R. Silapunt

(Assoc. Prof. Rardchawadee Silapunt, Ph.D.)

Head of Electronics & Telecommunication Engineering Dept.

Name.....ID no.....

(1-30) Mark X over the best choice in the answer sheet on page 9 (1 point each)

1. Calculate the noise power at T 300K, BW. 100MHz.

   a. 0.3 pW b. 0.4pW c. 0.5 pW d. 0.6 pW

2. Convert your answer to dBm.

   a. -93.8 dBm b. -103.8 dBm c. -111.8 dBm d.-115.7 dBm

3. Calculate the equivalent noise temperature when the noise factor is 1.5

   a . 130K b. 135K c. 140K d. 145K

4. While operating an RF amplifier, the input noise is measured as -100 dBm and the o/p is at -99.7 dBm. Calculate the noise factor of this amplifier.

   a. 1.0755 b. 1.2755 c. 1.0715 d. 1.0015

5. If the circuit in 4 employ a BJT, find the noise figure of this BJT?

   a. 1.7 dB b. 1.2 dB c. 0.3 dB d. 0.7 dB

6. What is the method that can prevent the spurious signals from the DDS?

   a. Applies a low pass filter after the DAC b. Decrease the clock frequency

   c. Increases the clock frequency d. Increase the number of bit

7. RF BJT amplifier at the receiver frontend is configured in common base for what purpose?

   a. Its input impedance is high b. Its input impedance is low

   c. High current gain d. Wide bandwidth

8. What is the noise level at T 290K in dBm/Hz?

   a. -178 dBm/Hz b. -177 dBm/Hz c. -175 dBm/Hz d.-174dBm/Hz

9. What is the range that the crystal oscillator can oscillate?

   a. At series resonance b. At parallel resonance

   c. Between series resonance and anti-resonance d. All is correct

10. What is the advantage of the PFD type phase detector when compare to the others?

    a. Higher Q b. Wider detection range

    c. Provides more o/p level d. All is correct

Name.....ID no.....

11. Why the charge pumped output is better than the logic output?

a. Suitable for connection with the external capacitor b. Provide higher voltage

c. Increases the voltage faster d. All is correct

12. The reactance of the crystal will be inductive at what frequency?

a. At series resonance freq. b. At frequency beyond the series resonance

c. At frequency lower than the series resonance d. No correct answer

13. S/N of the FM radio can be improved if the input C/N is more than one specific value, this is called...?

a. Capture range b. Threshold effect

c. Capture effect d. No correct answer

14. What could the FM transmitter do to increase the S/N of the FM radio receiver?

a. Increases the carrier frequency b. Increase the deviation

c. Increases the transmitted power d. All is correct

15. Phase noises of an integer frequency synthesizer can be increased if ?

a. Connects a capacitor to the power supply b. V_{DD} is increased

c. N is increased d. All is correct

16. The unit for the phase noise is?

a. dB b. dBc c. dBC/Hz d. dBm

17. Which one should be the first consideration for the linearity of an amplifier?

a. Gain b. High IP2 c. High IP3 d. All is correct

18. The ST cut provide better performance to the crystal. How ?

a. Low temperature Coefficient b. Low resistance

c. Hi Accuracy d. All is correct

19. Which statement is correct?

a. Capture range > Lock range b. o/p of the PFD is Tri state

c. Under modulation leads to distortion d. No correct answer

20. Find the noise figure that is comparable to the equivalent noise temp of 120K ?

a. 1.2 dB b. 1.3 dB c. 1.4 dB d. 1.5 dB

Name.....ID no.....

21. Calculate the power over a 50 Ohm load by 1 μV_{rms} signal?

a. -107 dBm b. -117 dBm c. -109 dBm d. -119 dBm

22. At 200KHz, what is true for a series RLC with R = 200 Ω, L = 10 μH, C = 0.01μF?

a. Current lag the voltage
b. Current lead the voltage
c. Current and voltage is in phase
d. Voltage is zero at resonant

23. A 50 + j1Ω source is connected to a 50Ω load, how is the circuit perform?

a. There is no effect at low frequency
b. It is inductive at low frequency
c. It is inductive at high frequency
d. All is correct

24. What is the condition that provides hi Z to the PD_{out} pin of the MC145152?

a. The positive going edge of F_R lead F_{IN}
b. The positive going edge of F_R lag F_{IN}
c. The positive going edge of F_R is in time with F_{IN}
d. No correct answer

25. Where can we observe the lock characteristics of the PLL?

a. At F_R
b. Output of Low pass filter
c. Output of Divide by N
d. At the output of the VCO

26. Locate the phase noise measurement point on the Integer N PLL?

a. At F_R
b. Output of Low pass filter
c. Output of Divide by N
d. At the output of the VCO

27. If the output of the Phase Frequency Detector remains at $+V_{DD}$ for > 2 periods of F_R . This means..

a. There is no phase difference from 2 inputs
b. It is in the phase detection mode
c. It is in the phase lock mode
d. It is in the frequency detection mode

28. What is the effect of noises to the FM signal?

a. Their amplitudes are combined
b. causes the phase shift
c. creates some deviation to the FM
d. All is correct

29. The aircraft radio communication utilized the AM modulation not FM because?

a. Capture effect is concerned
b. Short communication range
c. the bandwidth is too wide
d. Less complicate circuit

Name.....ID no.....

30. The ADC with high DR is very useful for a radio receiver application because?

a. less gain is needed for an amplifier b. increases the ability to receive lower level signal

c. Sensitivity of the receiver is increased d. all is correct

(31 – 43) Answer the question in the blank (2 points each)

31. An amplifier with the i/p and o/p impedance of 50 Ω has the voltage gain of 200, 100KHz bandwidth and NF = 0. Calculate the V_N at the input at T = 300 K. .....

32. What equation is best described the need of an LNA at the front end of the receiver?.....

33. At the maximum transmit power of 1.5W: SSB and AM can be compared and found that the maximum power in the USB of an AM signal is .....W.....which is equivalent to .....%....of the SSB.

34. Design a low pass L matching network for the 1000Ω R_S and 50+j18 Ω R_L at 1.5 MHz.

.....

35. A $2m^2$ aperture antenna can received 6×10^{-13} W signal transmitted from the satellite. Calculate the Effective radiated power from the satellite if the path loss is known to be 140 dB?.....

36. The side band of an RF carrier (0dBm) is measured by a spectrum analyzer with 1 KHz bandwidth at 10KHz offset as –60dBm. The phase noise of this carrier is .....

37. Give two examples to detect the FM signal by using the DSP (Digital Signal Processing) .....

.....

38. Recommend the frequency source to use as the LO. In the IQ Modulator in the 170-200MHz band?

....

39. What will happen if the gain of the LNA in the frontend is set too high?

....

40. The super heterodyne radio receiver is designed to overcome these problems? .....

.....

41. Modern day's radio solved the image freq. problems without the needs of the hi Q filter by using this method... .....

42. What is the meaning of Low IF in the radio receiver ....

43. The best way to solve Intermodulation of an amplifier is.....

Name.....ID no.....

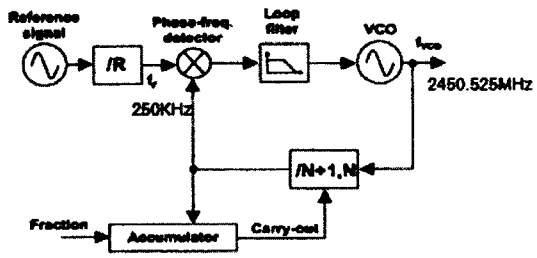
44. Two amplifiers A and B have equal bandwidth of 500MHz and the gain of 30dB. Operating temperature is 290K. "A" has equivalent noise temperature of 170K but "B" has 120K? If the signal of -75dBm (minus 75dBm) is fed into each amplifier, calculate the noises power at the output of each amplifier? (10 points)

45.Calculate L,C of the L matching network in order to match the 50+j0 Ohms source to 200 Ohms load at 800 MHz. The matching network should not allow the dc to pass through. (5 points)

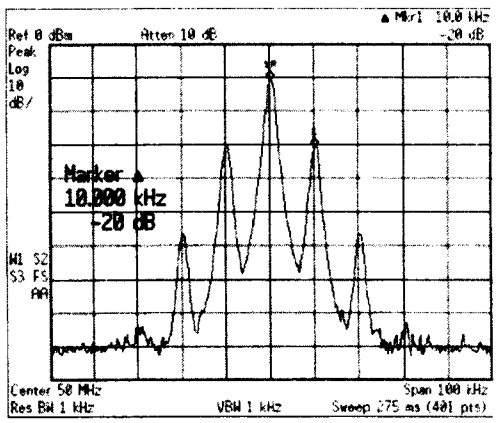
Name.....ID no.....

46. Calculate the Neff and draw the timing diagram for the counting of n and n+1 from the following diagram. (5 points)

Solution



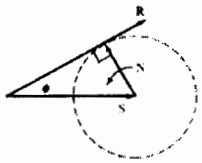
47. The input of a spectrum analyzer is connected to the -60dB RF sample port from a FM transmitter. The result is shown in the figure in 10db/div. scale. The J_0 is -10dBm. Calculate the output power of this transmitter? (5 points)



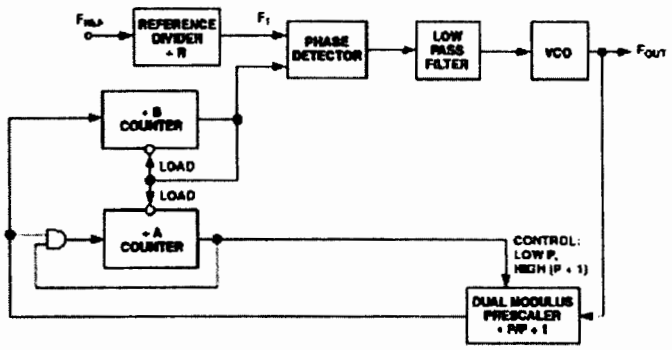
48. Draw the block diagram of the Armstrong`s signal ($A_m \cos(\omega_m t) A_c \cos(\omega_c t) + A_c \sin(\omega_c t)$)(5 points)

Name.....ID no.....

49. A FM signal with the magnitude of 2 mixed with the noises with magnitude of 1 as shown below. The phase and amplitude of the resultant FM signal follows the equation; $\Delta f = \phi_{rad} \times f_m$. Describe the method to compensate for this effect.? (5 points)



50. Describe the operations of the following diagram. Find the total division value and calculate the F_{out} when F1 = 25KHz, P = 128, B = 300, A =5 (10points)



Name.....ID no.....

Answer sheet (Mark X over the only one selected choice)

1. (a) (b) (c) (d)
2. (a) (b) (c) (d)
3. (a) (b) (c) (d)
4. (a) (b) (c) (d)
5. (a) (b) (c) (d)
6. (a) (b) (c) (d)
7. (a) (b) (c) (d)
8. (a) (b) (c) (d)
9. (a) (b) (c) (d)
10. (a) (b) (c) (d)
11. (a) (b) (c) (d)
12. (a) (b) (c) (d)
13. (a) (b) (c) (d)
14. (a) (b) (c) (d)
15. (a) (b) (c) (d)
16. (a) (b) (c) (d)
17. (a) (b) (c) (d)
18. (a) (b) (c) (d)
19. (a) (b) (c) (d)
20. (a) (b) (c) (d)
21. (a) (b) (c) (d)
22. (a) (b) (c) (d)
23. (a) (b) (c) (d)
24. (a) (b) (c) (d)
25. (a) (b) (c) (d)
26. (a) (b) (c) (d)
27. (a) (b) (c) (d)
28. (a) (b) (c) (d)
29. (a) (b) (c) (d)
30. (a) (b) (c) (d)

Formulas

Noises $P_n = kT\Delta f$ $e_n = \sqrt{4kT\Delta f R}$ $i_n = \sqrt{2qI_{dc}\Delta f}$

$F_N = \left[\frac{P_{NO}}{P_{NI}}\right]_{T=290K}$. $F_N = \frac{S_{NI}}{S_{NO}}$. $NF = 10\log(F_N)$. $F_N = 1 + \frac{P_a}{GKTB}$

$T_e = T_0\, log^{-1}\left[\frac{NF}{10}\right] - 1$ Noise temperature (T) = 290 * (10^(NF/10)-1) (Kelvin)

L network $Q_S = Q_P = \sqrt{\frac{R_{Larger}}{R_{smaller}} - 1}$. $\frac{X_L}{R_{source}} = \frac{R_{load}}{X_C}$. $L_1 = \frac{X_L}{\omega_0} = \frac{Q_S R_{smaller}}{\omega_0} = \frac{R_{Larger}}{\omega_0 Q_P}$ $C_1 = \frac{1}{\omega_0 X_C} = \frac{1}{\omega_0 Q_S R_{smaller}} = \frac{Q_P}{\omega_0 R_{Larger}}$

Friss's formula $Overall\ F_N = F_1 + \frac{F_2 - 1}{G1} + \frac{F_3 - 1}{G1G2} + \cdots + \frac{F_n - 1}{G1G2 \ldots Gn-1}$

Decibel conversion $dBm = 10\log\left[\frac{P_{watts}}{0.001}\right]$. $dBm = 10\log(P_{mW})$

Single modulus pre-scaler $F_o = NMf_{ref}$ Two modulus pre-scaler $F_{vco} = (MN+A)\, f_r$

Fractional N $F_{vco} = F_r (N + K / F)$ N,K,F is the integer

Where F = total cycles in one round (8 means resolution 1/8 of Fr)

K = cycles in one round that N become N+1

N_{eff} = (N(F-K)+(N+1)K)/F = N+K/F

AM $m = \frac{(B-A)}{(B+A)}\ x\ 100\%$ *or* %m = (E_i/E_c) x100% $P_t = P_c(1 + \frac{m^2}{2})$

Sin A Sin B = 1/2cos(A-B) - 1/2 cos(A+B) $e = E_c \sin\omega_c t + \frac{mE_c}{2}\cos(\omega_c - \omega_i)t - \frac{mE_c}{2}\cos(\omega_c + \omega_i)t$

Cos A Cos B = 1/2cos(A+B) - 1/2 cos(A-B) $E_{SF} = \frac{mE_c}{2}$

FM noises $\Delta f = \phi_{rad}\ x\ f_m$

$B.W._{carson} = 2(\Delta f + f_m) = 2\Delta f + 2f_m$

Armstrong`s signal = $A_m \cos(\omega_m t)\, A_c \cos(\omega_c t) + A_c \sin(\omega_c t)$