Seat No.

King Mongkut University Of Technology Thonburi

Midterm Examination Semester 1/2016

Subject : EIE 326 Electronics Communication ~~Engineering~~

Student: 3rd Yr. Electronics & Telecommunication Eng.

Date: September 26th, 2016 **Time:** 09.00-12.00PM

Instructions

1. There are 48 questions 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

Associate Professor Rachawadee Silapan

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. From 1, calculate the thermal noise voltage at the input of the receiver with the input impedance of 75 ohms?

   a. 7 μV b. 8 μV c. 9 μV d. 10 μV

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 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. What is the method that the FM transmitter deals with zero carrier amplitude?

a. no action
b. Equalizer
c. Pre emphasis
d. Phase locked loop

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

a. Capture range
b. Threshold effect
c. Capture effect
d. all is correct

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. Noises from an integer frequency synthesizer can be reduced by...?

a. connects a capacitor to the power supply
b. Increase the V_{DD}
c. lowers the value of N
d. all is correct

16. What is the unit for phase noise measurement?

a. dB
b. dBc
c. dBC/Hz
d. all is correct

17. At frequency lower than the series resonance, the impedance of a crystal is...?

a. Resistive
b. Inductive
c. Capacitive
d. all is correct

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

a. Low temperature Coefficient
b. Low resistance
c. Hi Accuracy
d. all is correct

19. Which one is true?

a. capture range > Lock range
b. o/p of the PFD is Tri state
c. under modulation leads to distortion
d. No correct answer

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

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

21. Calculate the power across the 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 PD_{out} pin of the MC145152 is "0"?

a. F_R lead F_{IN}
b. F_R is follow F_{IN}
c. F_R is in time with F_{IN}
d. no correct answer

25. 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 input of Divide by N

26. The O/P 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

27. What is the effect of noise 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

28. What is the solution for the noise triangle characteristic of the FM radio?

a. pre emphasis
b. Limiter
c. Balanced modulator
d. no correct answer

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

29. How to reduce the locking time for the PLL?

a. increases the loop bandwidth
b. Increase the F_R
c. increase the loop gain
d. all is correct

30. What is the strong point of the AM radio system?

a. Easy to build receiver
b. Efficient bandwidth
c. High efficiency
d. all is correct

(31 – 40) 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. Calculate the output P_N .....

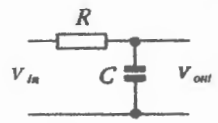
33. Calculate F_N ....

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. Can we use a low pass filter instead of the integrator in the indirect FM generator?



....

37. Reason for 36.

.....

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.What is the bad situation that resulting from the capture effect?.....

.....

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

41. 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 75 dBm) is fed into each amplifier, calculate the noises power at the output of each amplifier? (10 points)

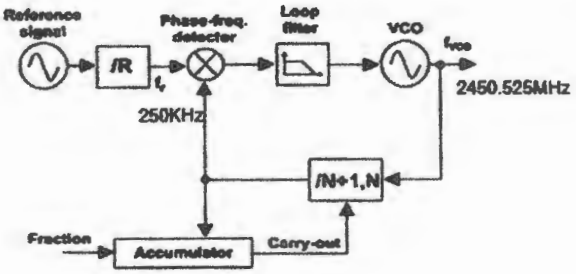
42.Calculate L,C of the L matching network in order to match the 50+j0 Ohms source to 200 Ohms load at 800 MHz. The matching network should not allow the dc to pass through. (5 points)

Solution

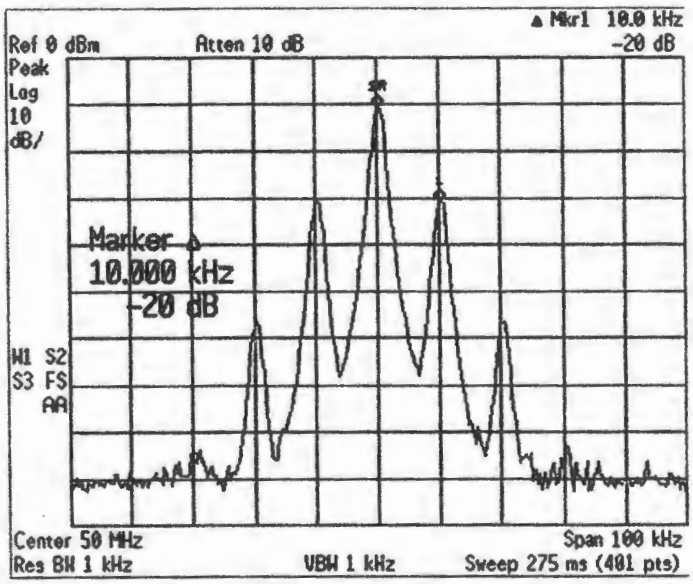
Name.....ID no.....

43. Draw the timing diagram for the counting of n and n+1 from the following diagram. (5 points)

Solution



44. Only 0.01% (via 50 dB coupler) of the RF output from a FM transmitter is coupling to the spectrum analyzer as shown in the figure by using the vertical scale as 10db/division. The J_0 is peak at -10dBm. Calculate the output power of this transmitter? (5 points)

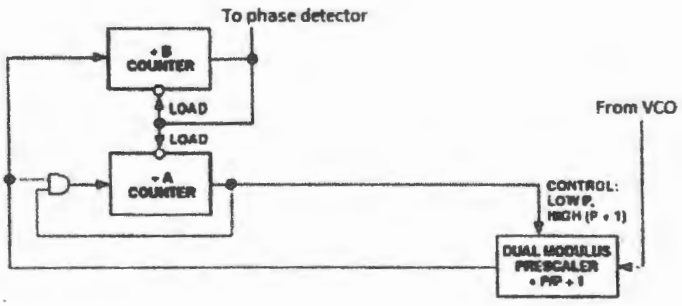


45.Draw the block diagram of the Armstrong`s signal $A_m \cos(\omega_m t) A_c \cos(\omega_c t) + A_c \sin(\omega_c t)$ (5 points)

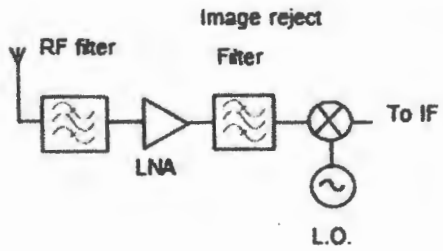
Name.....ID no.....

46. Explain the meaning of $\Delta f = \phi_{rad} \times f_m$ with some mathematics example.(5 points)

47. Describe the operation of the following diagram (10points)



48. Describe the components and the operation of the frontend in the super heterodyne radio receiver (5 points)



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

$$P_n = kT\Delta f$$

$$e_n = \sqrt{4kT\Delta f\, R}$$

$$i_n = \sqrt{2qI_{dc}\Delta f}$$

$$L_1 = \frac{X_L}{\omega_0} = \frac{Q_S R_{smaller}}{\omega_0} = \frac{R_{Larger}}{\omega_0 Q_P}$$

$$C_1 = \frac{1}{\omega_0 X_C} = \frac{1}{\omega_0 Q_S R_{smaller}} = \frac{Q_P}{\omega_0 R_{Larger}}$$

$$Q = Q_s = Q_p = \sqrt{\frac{R_{Larger}}{R_{smaller}} - 1}$$

$$\frac{X_L}{R_{source}} = \frac{R_{load}}{X_C}$$

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

$$F_N = \left[\frac{P_{NO}}{P_{NI}}\right]_{T=290K}$$

$$F_N = \frac{S_{NI}}{S_{NO}}$$

$$NF = 10\log(F_N)$$

$$T_e = (F_N - 1)T_0$$

$$T_e = T_0\left(log^{-1}\left[\frac{NF}{10}\right] - 1\right)$$

Sin A Sin B = 1/2cos(A-B) - 1/2 cos(A+B)

Cos A Cos B = 1/2cos(A+B) - 1/2 cos(A-B)

$$m = \frac{(B-A)}{(B+A)}\ x\ 100\%$$

$$F_N = 1 + \frac{P_a}{GKTB}$$

$$e = E_c \sin\omega_c t + \frac{mE_c}{2}\cos(\omega_c - \omega_i)t - \frac{mE_c}{2}\cos(\omega_c + \omega_i)t$$

$$E_{SF} = \frac{mE_c}{2}$$

$$P_t = P_c\left(1 + \frac{m^2}{2}\right)$$

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

$$dBm = 10\log\left[\frac{P_{watts}}{0.001}\right]$$

$$dBm = 10\log(P_{mW})$$