King Mongkut's University of Technology Thonburi
Final Examination
Semester 1 -- Academic Year 2013

Subject: EIE 326 Electronics Communication Engineering

For: Electrical Communication and Electronic Engineering, 3$^{rd.}$ Yr. English program

Exam Date: November 26th , 2013   **Time:** 09.00-12.00

Instructions:-
1. There are 9 problems in 13 pages, including the cover, total score is 150.
2. Answer sheet in on page 12 and the formulas are on page 13
3. No document allowed
4. Answer each problem in the exam. papers.
5. KMUTT 'rule compiled calculator is allowed.
6. Do not bring any exam papers and answer sheets outside the exam room.

Remarks:-
- **Raise your hand when you finish the exam to ask for a permission to leave the exam room.**

- **Students who fail to follow the exam instruction might eventually result in a failure of the class or may receive the highest punishment with university rules.**

Exam No.	1	2	3	4	5	6	7	8	TOTAL
Full Score									
Graded Score									

Name _____ **Student ID** _____

Assistant Prof. Chanin Wongngamkam Tel: 9073

This examination has been approved by the committees of the ENE department.

A. Wudhidan

(Assoc. Prof. Wudhichai Assawinchaichote, Ph.D.)
Head of Electronic and Telecommunication Engineering Department

Instruction: Mark X over the selected choice in the answer sheet on page 12. (1 point each)

1. Surface wave propagation may occurs on this band ?

    a .MF   b. HF

    c. VHF   d. UHF

2. Which signal is the most suitable for the transmission in the cable ?

    a.NRZ bipolar   b. NRZ unipolar

    c.RZ unipolar   d. RZ bipolar

3. Coding for the Forward error correction (FEC) is characterized as

    a .Channel coding   b. Source coding

    c. Line coding   d. All is correct

3. Feed the FM +/- 75KHz into the standard FM discriminator through the bandpass with 15KHz bandwidth ?

    a . volume will increase   b. Audio will distort

    c. volume will decrease   d . No audio at the output

5. TTL level(0,5V) can also called as

    a.NRZ bipolar   b. NRZ unipolar

    c.RZ unipolar   d. RZ bipolar

6.Output from this circuit will have equal amplitude?

    a .diode detector   b. PLL

    c. limiter   d .no correct answer

7. These may result from the RF amplifier ?

    a .Harmonics   b. Spurious frequencies

    c. Noises sidebands   d . all is correct

8. This may be the cause of the noise that appears within the IF bandwith.

    a .harmonics content   b. Spurious frequencies

    c. LO sidebands   d . Waveform distortion

9. What cause the operation of the squelch circuit in LM3371?

    a .noises   b. Intermediate frequency

    c. voice   d . Silent

10. What is the main purpose of the second filter following the RF amplifier ?

    a .To reject the image frequency   b .To eliminate noises.

    c. To reject the harmonics   d .To increase gain

11. Output from the envelope detector can feed through the rectifier,then low pass filter with 1 second time constant in order to get ?

    a.Automatic gain control   b. Pre emphasis

    c.Noise detector   d . Phase detector

12. 2nd IF 455 KHz in the double conversion receiver cannot provide this function.

    a. harmonics rejeetion   b. Bandwidth control

    c. Image frequency rejection   d .no correct answer

13. High Intermediate frequency in the superheterodyne receiver will.. ?

    a .Move the image frequency away   b . Bring the image frequency closer

    c . lower the bandwidth   d . no correct answer

14. What is the purpose of the Tank or LC network in the quadrature detector?

    a   . IF filtering   b .IF blocking

    c   .convert FM to PM   d .90 phase shifter

15. Which one can solve the problem of Blocking?

    a. Band pass filter   b .Low pass filter

    c .High pass filter   d .Limiter

16. Capture effect can be minimized by utilizing ?

    a .Double conversion method   b. Addition of a low pass filter

    c .Additional bandpass filter   d .Addition of a Limiter

17. Calculate the minimum distanee between the reuse frequency cell in the network with the hexagonal shape cell. Given the longest distance from the center of the cell equal to 5 Kilometers ?

    a . 22.15 Km   b. 25.05 Km.

    c. 22.95 Km.   d. no correct answer

18. Compare -100 dBm and 1×10^{-6} Vrms at 50 Ohms load?

    a . Cannot compare difference unit   b. -100 dBm is bigger

    c. -100 dBm is smaller   d. Both are equal

Use the following diagram for question 19 – 22
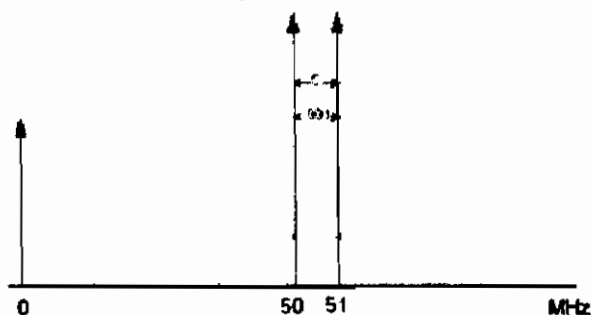
19. Which one is the harmonics ?

    a. 48 MHz   b. 101 MHz

    e. 52 MHz   d 100 MHz

20. Which one is the 3rd order product. ?

    a. 48 MHz   b. 101 MHz

    c. 52 MHz   d 100 MHz

21. Which one is not able to reject by the filter?

    a. 48 MHz   b. 101 MHz

    c. 52 MHz   d 100 MHz

22. Which one is the 5th order product. ?

    a. 48 MHz   b. 101 MHz

    c. 52 MHz   d 100 MHz

23. Which one is close to the fifth order produet ?

    a. 25MHz   b. 101 MHz

    c. 52 MHz   d 100 MHz

24. Which one is the main purpose of the 1st IF ?

    a .image frequency rejection   b . noise control

    c. selectivity   d .Bandwidtb control

25. Which one is the main purpose of the de emphasis network?

    a .increase thc higb tone level   b. Deerease the bigh tone level

    c. control the deviation   d .Decrease the low tone level

26. High IP3 means ?

    a .more linearity   b. More gain

    c. less linearity   d all is correct

27. IP3 of the amplifier can be elliminated by ?

    a .decrease the level of input signal   b. Always use only one input

    c. Gain setting is always maximum   d Gain setting is always minimum

28 . This circuit provide the 2nd order product ?

    a.Bandpass filter   b. mixer

    c. Combiner   d IF amplifier

29. What is the function of the squelch circuit?

    a.   to increase the sound quality   b. To eliminate the noise

    c.   to lower the noise   d. To limit the level

30.Squelch is useful for?

        a. minimize the battery consumption   b. minimize the higher tone

        c. minimize the lower tone   d. minimize the interferences

31. Some type of radio receiver utilizes an up converter at the front end in order to ?

        a . Get better image rejection   b. block IMP3

        c. block harmonics   d. block IMP2

32. What is the purpose of the RF amplifier?

        a. To increase the sensitivity   b. block IMP3

        c. eliminate the harmonics   d. block IMP2

33. Which receiver make the 1st conversion at the antenna?

        a . Satellite TV   b. SSB radio

        c. VHF TV   d. FM narrowband radio

34. Which one is not true for QPSK?

        a. Bandwidth is half of BPSK   b. adopted IQ modulator

        c. can use class C amplifier   d. All choices

35. Which one require the widest bandwidth ?

        a . Satellite TV receiver   b.   SSB receiver

        c. VHF TV receiver   d.   FM narrow band receiver

36. What kind of terrain reflects more microwave signal than others ?

        a .Flat terrain   b.   Hilly terrain

        c. rough terrain   d.   desert terrain

37. Skip Zone can be decreased by?

        a . increase the antenna's elevation angle   b.   decrease the antenna's elevation angle

        c. increase the transmit power   d.   decrease the transmit power

38. F1 and F2 layer is separated because of

        a. solar flare   b.   sun spot

        c. sun light   d.   no correct answer

39. What is the result of total reflection at D layer

        a . Hop distance is lower   b. Hop distance is increased

        c. no effect to hop distance   d. Radio wave will reflected back to transmitter

40. Convert the return loss of 20dB into VSWR?.

    a. 1.202 dB   b. 1.212 dB

    c. 1.222 dB   d. no correct answer

41. Which one is the process for adding the clock into the data stream ?

    a. Interleaving   b. Scrambling

    c. IQ modulating   d. mapping

42. This repeater can only change beam direction

    a. Passive repeater   b.   RF repeater

    c. Heterodyne repeater   d.   Regenerative repeater

43. Current and voltage at ¼ wavelength from the open end of the TX. line ?

    a. current max,voltage min   b.   current max,voltage max

    c. current min,voltage min   d.   current min,voltage max

44. Current and voltage at ¼ wavelength from the shorted circuit end of the TX. line ?

    a. current max,voltage min   b.   current max,voltage max

    c. current min,voltage min   d.   current min,voltage max

45. Which one is the best low loss insulator for a coaxial cable ?

    a. air   b.   plastic

    c. ceramic   d.   no correct answer

46. Calculate the velocity of the signal travelling in a coaxial cable ($\varepsilon_r = 3$)?

    a. 299.75×10^8 m/s   b. 199.06×10^8 m/s

    c. 173.20×10^8 m/s   d. no correct answer

47. Calculate the length of a dipole antenna operate at 156 MHz?

    a. 0.85 meter   b. 0.96 meter

    c. 0.78 meter   d. 0.99 meter

48. Calculate the reflection coefficient (Γ) if the measured VSWR = 1.75

    a. 0.15   b. 0.27

    c. 0.30   d. no correct answer

49. Multipath fading can be minimized by using this method?

    a. polarized diversity   b. space diversity

    c. frequency diversity   d. no correct answer

50. Front to back of a dipole antenna is around ?

    a. 10   b. 5

    c. 2   d. 1

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2. Write down the solution and answer in the space below (24 points)

2.1 Calculate the velocity factor of a transmission line with PTFE insulation($\varepsilon_r = 2.1$) (3 points)

2.2 Calculate Z_o of a parallel line which have 4mm connectors Ø space 300 mm apart by PVC (3 points)

2.3 Calculate the diameter (Ø) of the outer conductor of a 50 Ohms PVC coaxial cable .Given the inner Ø = 1.5 mm(3 points)

2.4 Calculate the Gain (dBi) of an antenna with $A_e = 1m^2$ operate at 10GHz, efficiency 70% (3 points)

2.5 Calculate reflection coefficient (Γ) when the measured VSWR is 1.5 (3 points)

2.6 Calculate the power that reflected from an antenna from Q2.5) When applying 100 W at its input terminal (3 points)

2.7. A microwave communieation system A and B working at 0.95GHz . The transmitting and receiving antennas are installed on the building located 20 km. apart. Calculate the radius of the 1st Fresnel zone at 6 km. from point A? (3 points)

2.8 Explain the knowledge from the result of Q2.7 (3 points)

3. From the following waveform, write down the incoming symbols from left to right .For example the most left symbols is 11 (I&Q) (5 points)
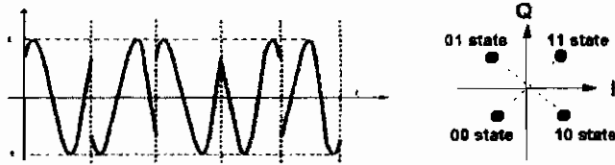
Answer……**11** ……………………………………………

4. Draw the block diagram of the system that provide the o/p of Q3) (5 points)
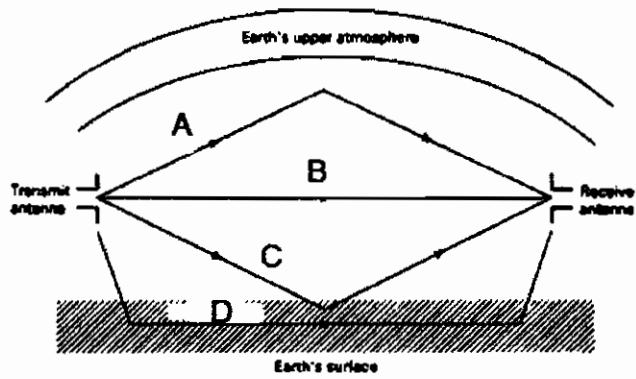
5. Explain the following diagram and draw the vectors for current and voltage for $f_{in} > f_r$ and $f_{in} < f_r$ (6 points)
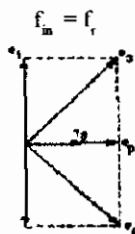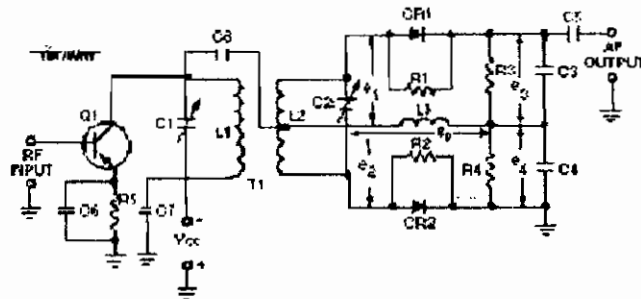
$f_{in} = f_r$ $f_{in} > f_r$ $f_{in} < f_r$

5. Explain all of the waves propagation in this drawing. (12 points)

6. Draw the block diagram of a narrow band FM radio transceiver and explain the operation of the receiver (10 points)

7. Explain the following words or phrases. (18 points)

7.1 7.1 Squelch operation of MC3371

7.2. Space diversity

7.3 Absorption fading

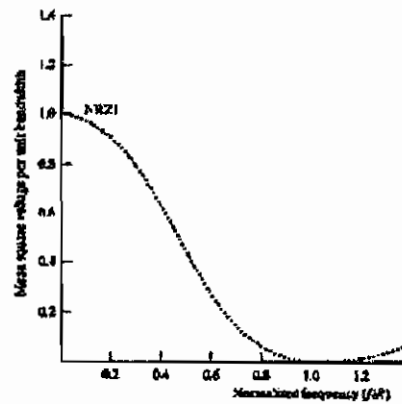7.4. Time interleaving

7.5. Multipath fading

7.6 Diffraction

8.Spectral density of the NRZ is shown below. Describe the methods that make the signal suitable for line transmission with the clock extraction capability and allow the using of repeaters then draw the waveform of the coded signal.(10 points)

9.Describe the details of the Troposcatter radio   (10 points)

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Answer Sheet (mark X over the best selected choice)

1.   (a)   (b) (c)   (d)   26. (a)   (b) (c)   (d)

2.   (a)   (b) (c)   (d)   27. (a)   (b) (c)   (d)

3.   (a)   (b) (c)   (d)   28. (a)   (b) (c)   (d)

4.   (a)   (b) (c)   (d)   29. (a)   (b) (c)   (d)

5.   (a)   (b) (c)   (d)   30. (a)   (b) (c)   (d)

6.   (a)   (b) (c)   (d)   31. (a)   (b) (c)   (d)

7.   (a)   (b) (c)   (d)   32. (a)   (b) (c)   (d)

8.   (a)   (b) (c)   (d)   33. (a)   (b) (c)   (d)

9.   (a)   (b) (c)   (d)   34. (a)   (b) (c)   (d)

10. (a)   (b) (c)   (d)   35. (a)   (b) (c)   (d)

11. (a)   (b) (c)   (d)   36. (a)   (b) (c)   (d)

12. (a)   (b) (c)   (d)   37. (a)   (b) (c)   (d)

13. (a)   (b) (c)   (d)   38. (a)   (b) (c)   (d)

14. (a)   (b) (c)   (d)   39. (a)   (b) (c)   (d)

15. (a)   (b) (c)   (d)   40. (a)   (b) (c)   (d)

16. (a)   (b) (c)   (d)   41. (a)   (b) (c)   (d)

17. (a)   (b) (c)   (d)   42. (a)   (b) (c)   (d)

18. (a)   (b) (c)   (d)   43. (a)   (b) (c)   (d)

19. (a)   (b) (c)   (d)   44. (a)   (b) (c)   (d)

20. (a)   (b) (c)   (d)   45. (a)   (b) (c)   (d)

21. (a)   (b) (c)   (d)   46. (a)   (b) (c)   (d)

22. (a)   (b) (c)   (d)   47. (a)   (b) (c)   (d)

23. (a)   (b) (c)   (d)   48. (a)   (b) (c)   (d)

24. (a)   (b) (c)   (d)   49. (a)   (b) (c)   (d)

25. (a)   (b) (c)   (d)   50.. (a)   (b) (c)   (d)

Equations

$$Z_0 = \frac{138}{\sqrt{\varepsilon}} = log_{10}\frac{D}{d}$$

$$Z_0 = \frac{276}{\sqrt{\varepsilon}} = log_{10}\frac{2D}{d}$$

$$v = \frac{C_0}{\sqrt{\varepsilon_{reff}}}$$

$$\phi_{webers} = B_{tesla} \times A_{square\ metres}$$

$$e_{rms} = n\omega\mu_r\mu_0 A H_{rms}\cos\alpha$$

$$\frac{\text{electric field strength }(E)}{\text{magnetic field strength }(H)} = 377\Omega$$
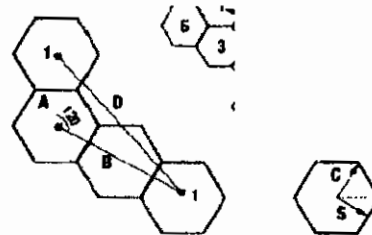
$$D^2 = A^2+B^2-2AB\text{x}COS(d)$$
$$D = 5.3S$$

$$C^2 = S^2+(C/2)^2$$
$$S^2 = C^2-(C/2)^2$$
$$S^2 = 0.75C^2$$
$$S = 0.866C$$

D=reuse distance

C= long cell radius

S= short cell radius

Antenna Gain $\qquad G = \frac{4\pi}{\lambda^2}A_e$

Return loss $\qquad \text{R.L.} = 20\ log_{10}(\Gamma) = 20\ log_{10}\left(\frac{VSWR - 1}{VSWR + 1}\right)$

Reflection Coefficient $\qquad \Gamma = \frac{Z - Z_0}{Z + Z_0}$

Voltage standing wave ratio $\qquad VSWR = \frac{1 + |\Gamma|}{1 - |\Gamma|}$

spreading loss $\qquad \frac{P_T}{P_R} = \left[\frac{4\pi d}{\lambda}\right]^2 = \left[\frac{4\pi df}{c}\right]^2$

Free space loss $= 32.44 + 20log(d_{km}) + 20log(f_{MHz})$

1st Fresnel zone $\qquad r = 8.657\sqrt{\frac{D}{f}}$