Tanta University
Faculty of Engineering

الفصل الدراسى الثانى	العام الجامعى : 2010-2011
الفرقة الثانية	شعبة هندسة الاتصالات
المادة: موجات كهرومغناطيسية (١)	زمن الامتحان : 3 ساعات
التاريخ : 2011/6/26	النهاية العظمى : درجة

1-a) Show that the ratio of the amplitude of the conduction current density and the displacement current density is $\sigma/\omega\varepsilon$ for the applied field $E=E_m \cos \omega t$. Assume $\mu = \mu_o$.

1-b) What is this amplitude ratio if the applied field is $E = E_m e^{-t/\tau}$, where τ is real.

2-a) Starting with Maxwell's equations for time varying fields to drive the wave equation for the electric field propagating in the +ve Z direction in free space. You may consider that the electric field strength has only X-component. Give an expression of the velocity of the wave propagating in free space, the wavelength, and the free space intrinsic impedance.

2-b) A 150-MHz uniform plane wave in free space is traveling in the a_x direction. The electric field intensity has a maximum amplitude of $200\ a_y+400\ a_z$ V/m at P(10, 30, -40) at t=0. Find: (i) ω, (ii) β, (iii) λ, (iv) υ, (v) η, (vi) E(x, y, z, t).

3-a) Drive an expression for the attenuation constant, phase shift constant and skin depth of a uniform plane wave propagating in good conductor.

3-b) Two uniform plane waves $E^{+}_{S1} = 120e^{-j4\pi Z}\ a_x$ and $E^{-}_{S1} = 30\angle 50^\circ e^{j4\pi Z}\ a_x$ V/m are both traveling in the same region of space. If this region is free space:
(i) find the operating frequency,
(ii) what intrinsic impedance in the region Z >0 would cause the given reflected wave.
(iii) at what value or values of $40 \le Z \le 0$ cm, is the amplitude of the total E field maximum.

4-a) Making use the wave equation to deduce an expression for the field components between two parallel perfect conducting planes with free space dielectric in the case of TM wave.

4-b) A wave propagates between two parallel planes which are separated by a distance a, the electric field for a TE mode is given as: $E_y = E_o Sin(\alpha x) e^{j(\omega t-\beta z)}$ and the magnetic field for a TM mode is $H_y = H_o Cos(\alpha x) e^{j(\omega t-\beta z)}$. Obtain the r.m.s magnetic field components for the TE mode.

5-a) Drive an expression of the input impedance of a lossless transmission line, and express the circuit element equivalent to the following transmission lines, :
(i) a $\frac{\lambda}{8}$ short circuit line, **(ii) a $\frac{3\lambda}{8}$ open circuit line**

5-b) A lossless transmission line has Z_o=100 Ω, βl=0.9π and υ=0.8 C. Let Z_R=125+j0 Ω. If V_s=200∠0 at 100 MHz in series with Z_s=50+j0 Ω is connected to the input of the line, find :
(i) The length of the line, (ii) Γ_R, (iii) SWR and, (iv) Z_{in} of the line at Z=-*l*.

PROBLEM # FOUR (15 mark)

I. **Synthesize the following functions using the suitable forms to get suitable networks**

a. $z(s)=\dfrac{(s+2)(s+5)}{(s+1)(s+3)}$

b. $Y(s)=\dfrac{2s+s^2}{3+4s+s^2}$

c. $z(s)=\dfrac{(s^2+1)(s^2+9)}{s(s^2+4)}$

PROBLEM # FIVE (20 mark)

I. **Having two OP AMPs and 0.1μF capacitors you are asked to :**

a. **Design fourth order low pass filter having cut off frequency of 100 Hz and achieve Butterworth characteristics. Determine additional components you need.**

b. **Calculate total gain of your design.**

c. **Change your design in (a) to obtain bandpass filter of high cut off frequency of 10kHz. Determine new component values needed.**

d. **Calculate the total gain of your new design in (c).**

e. **Sketch pole location in S domain and filter frequency response for both filters.**

Good Luck,

Dr. Salwa Serag Eldin

	TANTA UNIVERSITY FACULTY OF ENGINEERING DEPARTMENT OF ELECTRONICS & ELECTRICAL COMMUNICATIONF EXAMINATION (*SECOND* YEAR)	
	COURSE TITLE: ELECTRONIC CIRCUITS II	COURSE CODE: EEC 2206

DATE: 22/6/2011	TERM: SECOND	TOTAL ASSESSMENT MARKS: 90	TIME ALLOWED: 3 HOURS

Answer the following questions

PROBLEM # ONE (20mark)

State whether the following statements are true or false, comment on your Answers

a. The power dissipated in the output stage should kept as less as possible
b. Power amplifiers are classified according to the collector voltage waveform that results when input signal is applied.
c. Class C power amplifier is used in Radio frequency such as mobile, Radio and TV.
d. Power transistors, usually has B less than 100, are characterized by their ability to handle large power or voltage while not providing much current gain.
e. The dc bias of class B power amplifier leaves transistor just off this is why class B does not dissipate power except when an input signal is applied.
f. Increasing power amplifier conduction angle increases efficiency.
g. Using diodes to drive transistors just on in class B power amplifier is better than using resistors.
h. Passive filters have advantage over active filters in having no limiting operating frequency.
i. For the same order, Butterworth filter provides more efficient approximation than Chebychev filters.
j. Sallen key circuit could be designed to give any type of first order filter.

PROBLEM # TWO (17 mark)

I. Derive an expression for the relation between efficiency and conduction angle for class C power amplifier

II. For class B power amplifier that uses 30v power supply and providing 20 v pk to 16Ω load, determine input power, output power, circuit efficiency, maximum output power and maximum BJT dissipation.

PROBLEM # THREE (18 mark)

I. Determine the order N of the Butterworth filter for which A_{max}= 1dB, $A_{min}\geq$20dB, and the selectivity ratio ωs/ωp=1.3. What is the actual value of minimum stopband attenuation realized? If A_{min} is to be exactly 20dB, to what value can A_{max} be reduced?

II. Design first order all-pass filter using both active and passive circuits. Determine the main usage of all pass filters in communication systems.

Please Turn Over →

Tanta University — Department of Physics & Mathematics — Faculty of Engineering

Course Title: Complex and Special Functions
Date: 2011 (2^{nd} term)

Year: 2^{nd} (comm.-)
Allowed time: 3hrs

(30) M

Problem number (1) **(a) Show that if f(z) is analytic then** $\Delta^2 \; |f(z)|^2 = 4 \; \left|\frac{df(z)}{dz}\right|^2$.

(c) Find all values of $(1+i)^{1+i}$.

(d) Show that $f(z) = z^n$ **is analytic and use Cauchy Reimain inequality find f \` (z).**

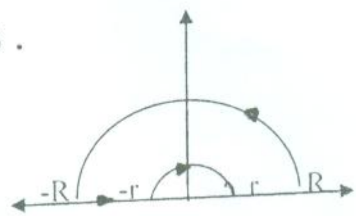
(30) M

Problem number (2) **(a)Evaluate** $\oint_C \frac{z^3+1}{(z-1)(z-5)} dz$, $C: |z| = 3$.

(b)Evaluate $\oint_C \frac{\sinh 3z}{(z-1)^4} dz$, $C: |z-1| = 3$.

(c)Evaluate

$\int_0^\infty \frac{\sin x}{x(x^2+1)} dx$ On the contour (R $\to \infty$, r $\to$ 0)



(35) M

Problem number (3)

(a)Show that (i) $\int_0^a x^5 J_2(x) dx = a^5 J_3(a) - 2a^4 J_4(a)$

(ii) $\beta(n, m-1) = \sum_{i=0}^{\infty} \beta(n+i, m)$

(b) Evaluate (i) $\int_0^\infty \sqrt{x}\, e^{-x^3} dx$ **(ii)** $\int_0^1 x(1-x^2) J_0(kx) dx$

(c) Use Generating function $e^{\frac{x}{2}(t-\frac{1}{t})} = \sum_{-\infty}^{\infty} J_n(x) t^n$ **to prove that:**

(i) $e^{ix\sin\theta} = J_0(x) + 2\sum_{n=1}^{\infty} J_{2n}(x)\cos 2n\theta + 2i \sum_{n=0}^{\infty} J_{2n+1}(x)\sin(2n+1)\theta$

(ii) $\cos x = J_0(x) + 2 \sum_{n=1}^{\infty} (-1)^n J_{2n}(x)$ (iii) $\sin x = 2 \sum_{n=0}^{\infty} (-1)^{n+1} J_{2n+1}(x)$

(30) M

Problem number (4)

(a) Show that if $f(z) = u(r,\theta) + iv(r,\theta)$ **is analytic, then** $r^2 u_{rr} + r u_r + u_{\theta\theta} = 0$.

(b) Evaluate $\oint_{|z|=3} z^2 \cosh(\frac{3}{z-1}) dz$

(c) Find Laurent's expansion of $f(z) = \frac{1}{z^2 - 3z + 2}$ **on the regions**

(i) $1 < |z| < 2$ **(ii)** $1 < |z-1|$

With my best wishes

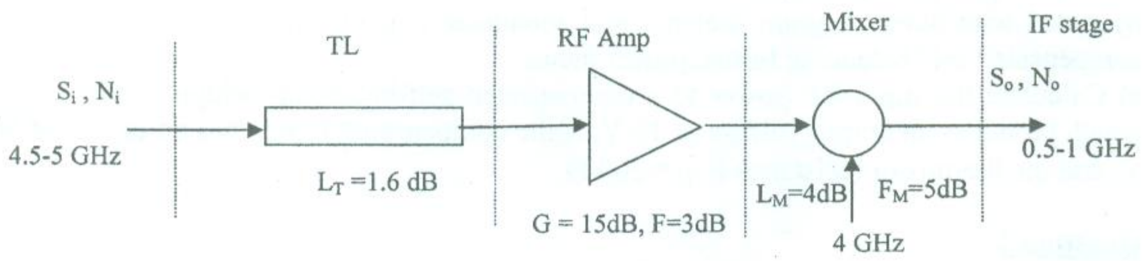
Dr. M.Shokry

b) What are the three methods used for noise figure measurements. Aided with diagrams and equations , explain the principle of operation of the "hot and cold" method.

c) The "hot and cold" method is used to measure the noise figure of an amplifier , if the cold load temperature is 77 K and the hot load temperature is 400 K, and the difference between attenuator readings is 4.0 dB , what is the noise figure of this amplifier (in dB)?

d) A microwave receiver has the block diagram shown below. If the system is balanced at ambient temperature ($T_0 = 290$ K), calculate :

- **i-** The overall gain in dB .
- **ii-** The overall noise figure in dB.
- **iii-** The output noise power N_0 (in dBm).
- **iv-** The receiver sensitivity (minimum signal to be detected).



Plank's constant h = 6.346×10^{-34} J.sec.

Boltzman's constant K = 1.38×10^{-23} J/K.

Good Luck

Tanta Univercity	*Final Exam.*	*Course : Electronic Measurments*
Faculty of Engineering		*Lecturer : Dr. M.Abdel Aziz*
Electronics &Comm. Dept.		*June 2011*
Second Year		*Time : 3 Hours*

Answer the following questions :

Question 1

a) Name the measuring device in which the following circuits are used .Explain briefly the operation of each circuit, indicating its function in the device :

i- Thermoelectric transducers.

ii- YIG tuned oscillators.

iii- Square-law detectors

b) Aided with block diagram sketches and equations, explain briefly the operation of a compensated self-balancing bridge power meter.

c) Calculate the input RF power to a compensated self-balancing bridge power meter, which produces an output voltage of 10 V, if the compensated bridge has an output of 16 V, and the thermistor resistance $R_{TH} = 200\ \Omega$.

Question 2

a) Why multiplexing technique is used in digital frequency meters (DFM)? Draw the block diagram, then explain the operation of a 5-digits DFM using multiplexing technique.

b)What are the three techniques used for extending the frequency range of a DFM. Aided with block diagrams , explain the automatic heterodyning technique.

c) An automatic heterodyning DFM has 7 band-pass filters with total coverage range from 1 GHz to 4 GHz in 500 MHz steps.

i-what is the input frequency, if the counter reads 234 MHz when the fourth filter is selected

ii- What is the counter reading if the input frequency is : 450 MHz, and 3.6 GHz.

Question 3

a) What are the basic techniques used for spectrum analysis. Draw the block diagram, and explain the principle of operation of one technique. .

b) A super-heterodyne spectrum analyzer (SA) has the first IF stage frequency $f_{if} = 2.2$ GHz, the VCO frequency range 3-5 GHz.

i- Find the SA frequency ranges for three harmonic mixing modes.

ii- Find the corresponding VCO frequency for an input signal frequency of 6 GHz .

c) Define and explain three unwanted responses in a super-heterodyne SA utilizing harmonic mixing.

d) Draw and label the display output of a SA for the following input signals:

i- Amplitude modulated signal with carrier frequency $f_c = 3$ GHz, amplitude $V_c = 10$ V , modulation index m = 15 %, and modulating frequency $f_m = 300$ MHz.

ii- Train of rectangular pulses with amplitude 5 V, repetition frequency $f_r = 10$ KHz, and pulse duration = 100 μs.

Question 4

a) Define the noise figure and the equivalent noise temperature of a component . Derive the relation between them.

Problem number (4)

(a) Describe briefly, aided with sketch of circuit diagram, the function of mixer, limiter and frequency discriminator.

(b) Sketch the block diagram of Stereophonic FM (transmitter and receiver). Sketch clearly the spectrum of signal output at each block diagram.

(c) Design an Armstrong indirect FM modulator (only the block diagram) to generate an FM signal with a carrier frequency of 96 MHz and carrier swing of 40 kHz. A narrow band FM generator with $f_c = 200\ kHz$ and adjustable Δf in the range of 9 to 10 Hz is available. The adjustable frequency range for oscillator is from 9 to 10 MHz, there is a bandpass filter with any center frequency, and only frequency doublers are available.

Problem number (5)

(a) Define the following terms: Aliasing, Nyquist rate, and Quantization error.

(b) Sketch the block diagram of the PCM, identifying briefly the function of each part.

Best Wishes of Success

Course Title: Communication Engineering	Course Code: EEC 2207	Year: 2nd
Date: 12 / 6 / 2011 (Second Term)	Allowed time: 3 hrs	No. of Pages: (2)

Remarks: (answer the following questions… assume any missing data… answers should be supported by sketches, equations)

Attempt all questions *Neat answers and boxed results are appreciated*

Problem number (1)

a- What are the fundamental limitations of any communication system?

b- Derive an expression for thermal voltage in a resistor at temperature T °K.

c- Calculate the noise voltage at the input of television RF amplifier, using a device that has a 200 ohm equivalent noise resistance and 300 ohm input resistor. The bandwidth of amplifier is 6 MHz and temperature 17°C.

Problem number (2)

a- Compare between low and high level modulation.

b- Sketch the block diagram of Costas receiver. Show that the phase discriminator output of Costas receiver is proportional to the average value of $m^2(t)$ multiplied by the phase error (assume small phase error).

c- Sketch the block diagram of a PLL and describe how loop acquisition is accomplished with PLL from an initial unlocked condition until frequency lock is achieved.

Problem number (3)

a- Define selectivity, sensitivity, and image frequency.

b- Explain how the design of receivers allows enhancing selectivity.

c- Figure 1 shows a block diagram of a wideband frequency modulator using indirect method. This modulator is used to transmit audio signals containing frequencies in the range of 100Hz to 15kHz and the desired output signal has carrier frequency of 100MHz and maximum frequency deviation. Determine the multiplication factor of the first and second multiplier, the carrier frequency, and the frequency deviation (at points 1, 2, 3 and 4), (Hint: The modulation index = 0.2).

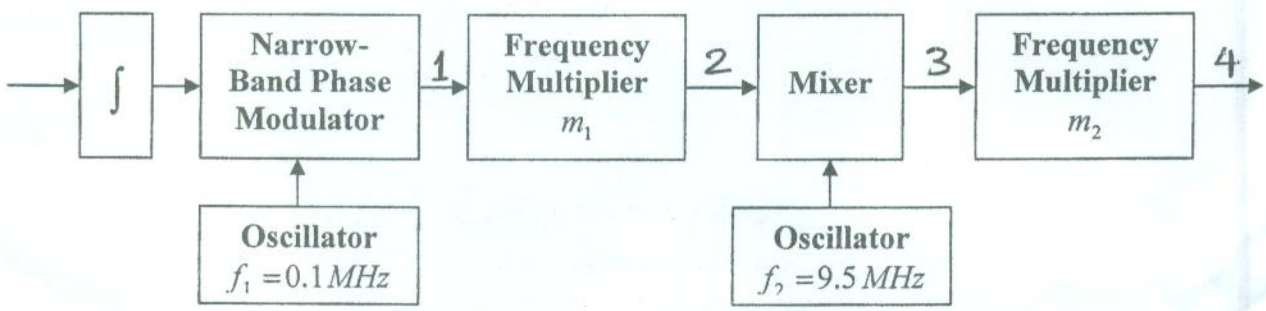


Figure 1

Problem number (3)   (10 Marks)

[a] Consider a unity negative feedback system with a forward transfer function

$$G(s) = \frac{k(s+3)}{s(s+2)}.$$

1) Draw the root locus for this system, (6 Marks)
2) Determine the damping ration for maximum oscillatory response. (2 Marks)
3) What is the value of k at this point of the locus? (2 Marks)

Problem number (4)   (20 Marks)

[a] For the system that have the following transfer function

$$G(s) = \frac{(s+3)}{(s+2)} \frac{(s+4)}{(2s^2+3s+5)}$$

Give the state space in pole-zero form (7 Marks) and in controllable form. (3 Marks).

[b] Draw the state diagram.

$$\dot{\underline{X}} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \underline{X} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} \underline{X}$$

Then, determine whether the given system in (b) is completely state controllable and observable or not. (6 Marks)

[c] Given a system described by the dynamic equations (4 Marks)

$$\frac{\mathbf{dx(t)}}{\mathbf{dt}} = \mathbf{Ax(t) + bu(t)} \qquad \mathbf{y(t) = cx(t)}$$

where

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -1 & -2 \end{bmatrix} \qquad b = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, \text{ and } \quad c = \begin{bmatrix} 1 & 1 & 0 \end{bmatrix}$$

Find:

(i) The characterstic equation.

(ii) Find the transfer function $Y(s)/U(s)$.

مع أطيب الأمنيات بالتوفيق

Tanta University | Department: Electronics and Electrical Communication Engineering | Faculty of Engineering

Total Marks: 70 Marks

Course Title: Control Engineering	Course Code: CCE2251	Year: 2^{nd}
Date: June 2011 (Second term)	Allowed time: 3 hrs	No. of Pages: (2)

Answer the following questions

Problem number (1) (21 Marks)

[a] Assume the electric system shown in Fig. (1), find: (10 Marks)

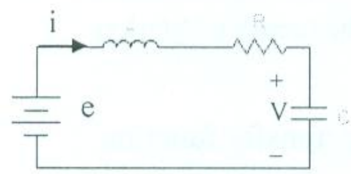


Fig.(1)

1) The time domain equations relating v(t) and e(t).
2) The transfer function V(s)/E(s).
3) If L = 1 mH and C = 4 μF, find the value of R that the v(t) has an overshoot of no more than 25%, assuming e(t) is a unit step.

[b] For the system has the transfer function $\frac{5}{s^2+s+6}$, assuming unity negative feedback

1) Compute the rise time and the percentage overshoot for the step input (5 Marks)
2) The error constants (4 Marks)
3) The steady state error for step input (2 Marks)

Problem number (2) (19 Marks)

[a] The characteristic equations of linear control systems are given below. Apply Routh-Hurwitz criterion to determine the root distribution and the system stability. (5 Marks)

1) $s^5+8s^4+2s^3+4s^2+2s+4=0$

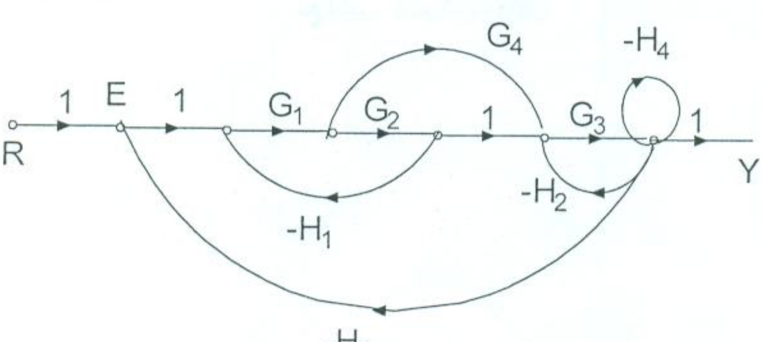
2) $s^6+s^5+2s^4+s^3+3s^2+2s+2=0$

[b] Apply Routh-Hurwitz criterion to determine the values of K for system stability. (4 Marks)

1- $\mathbf{s^3+4Ks^2+(K+5)s+10=0}$

2- $\mathbf{s(s^3+3s+3)+K(s+2)=0}$

[c] Using signal flow graph, find the transfer function of the system



$\mathbf{Y(s)/R(s)}$ (8 Marks) and $\mathbf{Y(s)/E(s)}$. (2 Marks)