Tanta University

Department: Electronics & Comm. Engineering

Faculty of Engineering

Total Marks: 90

Course Title: Communications Eng.	Course Code: EEC 2207	Year: 2nd
Date: June 2014 (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...etc)

Question number (1) (21 Marks)

1.**(a)** The noise produced by a resistor is to be amplified by a noiseless amplifier having a voltage gain of 75 and a bandwidth of 100 kHz. A sensitive meter at the output reads 240 μV rms . Assuming operation at 37 °C , calculate the resistor's resistance . If the bandwidth were cut to 25 kHz, determine the expected output meter reading. ($k = 1.38 \times 10^{-23}$ J/K)

(b) A single stage amplifier has a 200 kHz bandwidth and a voltage gain of 100 at 27 °C . A 1mV signal is applied to the amplifier input .If the amplifier has a 5 dB NF and the input noise is generated by a 2 kΩ resistor . Neglecting the external noise, determine the output noise voltage ,

(c) Using the circuit diagram , explain the reason that a Clapp oscillator has better frequency stability than the Colpitts Oscillator.

Question number (2) (21 Marks)

a) Sketch the block diagram of a phased locked loop and explain the three possible states of its operation?

b) The VCO of PLL free-runs at 7 MHz. The VCO does not change frequency until the input is within 20 kHz of 7 MHz. After that condition the VCO follows the input to ±150 kHz of 7 MHz before the VCO starts to free run again. Determine the PLL lock and capture range. Discuss your results.

c) A transmitter with a 10kW carrier transmits 11.2 kW when modulated with a single sine wave. Calculate the modulation index . If the carrier is simultaneously modulated with another sine wave at 50% modulation, calculate the total transmitted power.

Problem number (3) (21 Marks)

a) Sketch the block diagram of a high level AM DSBFC transmitter and explain the function of each block.

b) A superheterodyne receiver tuned to 1 MHz has the following specifications:

RF amplifier: P_G = 6.5 dB , R_{in} = 50 Ω Detector : 4 dB attenuation

Mixer: P_G = 3 dB Audio amplifier : P_G = 13 dB

3 IFs : P_G = 24 dB each at 455 kHz.

The antenna delivers a 21 μV signal to the RF amplifier.

(i) Calculate the receiver image frequency and input / output power in watts and dBm.

(ii) Draw a block diagram of the receiver.

c) (i) Explain the difference between single tuned transformers and double tuned transformers.

(ii)Determine the overall bandwidth for :

- Two single tuned amplifiers each with a bandwidth of 10 kHz .
- Three single tuned amplifiers each with a bandwidth of 10 kHz .
- A double tuned amplifier with a critical coupling = 0.02 and a resonant frequency of 1MHz .

Question number (4)　　　(27 Marks)

(a) Draw the SSBSC FDM system block diagram , explain its operation , and sketch the output frequency spectrum.

(b) Draw the circuit diagram of squelch circuit , explain its operation and describe its importance in a radio communications receiver.

(c) An FM signal is given by $2000 \sin(2 \pi \times 10^8 t + 2\sin \pi \times 10^4 t)$, is applied to a 50Ω antenna determine: (i) the carrier frequency (ii) the transmitted power (iii) the modulation index (iv) frequency of modulating signal (v) Bandwidth using Carson's rule

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Good Luck ....

Course Coordinator: Prof. Mustafa Mahmoud

Tanta University

Department: Electronics & Comm. Engineering
Total Marks: 75 Marks

Faculty of Engineering

Course Title: Electronic Measurements (2)	Course Code: EEC2209	Year: 2^{nd}
Date: June 2014 (Second term)	Allowed time: 3 hrs	No. of Pages: (1)

Remarks : (answer the following questions... assume any missing data... answers should be supported by sketches...etc)

Question number (1) (15 Marks)

(a) Explain the working principles , construction and features of high resistance passive divider probe .

(b) Explain how probe capacitive loading affects the rise time of fast transition waveforms .

(c) How do you test whether the probe is properly compensated ?

Question number (2) (15 Marks)

(a) The Wheatstone bridge has $R_1 = (1000 \pm 0.5)\Omega$ and $R_2 = (2000 \pm 0.5)\Omega$ .At the balance point, $R_3 = (1060 \pm 0.5)\Omega$ .Calculate the value of unknown resistance, R_4, and the fractional uncertainty in its value.

(b) Explain how Whestone bridge can be used to detect location of ground faults in cables.

(c) Sketch the circuit diagram of remote connected Wheastone bridge, Explain how three wire connection can be used to minimize the effect of wiring resistance on the bridge output.

Question number (3) **(15 Marks)**

(a) (i) Which bridge will you use to determine the value of an inductor and its quality factor in terms of known capacitance. Draw its circuit diagram and derive its balance equations.

(ii) Find the series inductance ,resistance and Q of an inductive element using Maxwell bridge. Given Z_1= parallel combination of resistor of value 470 Ω and a capacitor of value 0.22 μF, $Z_2 = Z_3 =$ 1k Ω . The bridge is driven by a 2 kHz source.

(b) Sketch the block diagram of a data logger and explain its operation.

Question number (4) **(15 Marks)**

(a) Sketch the block diagram of the universal counter ,and explain the function of each block. Explain the major sources of measurement errors for an electronic counter.

(b) Sketch the block diagram of the modern type signal generator, and explain the function of each block. State its advantageous and disadvantageous.

Question number (5) **15 Marks)**

(a) Explain the construction , operation and applications of the heterodyne wave analyzer.

(b) Sketch the block diagram of swept superheterodyne spectrum analyzer ,and explain the function of each block . Explain its various characteristics.

Good Lucck ....Prof. Mustafa Mahmoud Abd Elnaby

Tanta University

Department: Physics and Engineering Mathematics

Faculty of Engineering

Total Marks: 70 Marks

Course Title: Engineering Mathematics 3 (b)	Course Code: PME2113	Year: 2^{nd} Communication
Date: 15/6/ 2014	Allowed time: 3 hrs	No. of Pages: (2)

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

Problem number (1) (20 Marks)

a) Find the image of the line $\text{Re}(z)=1$ under $f(z)=z^2$. — 5 Marks

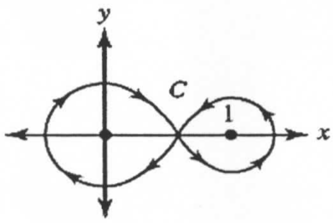
b) Find all values of z such that 1) $z^4+1=0$ 2) $\cos z = 10$ — 5 Marks

c) Find an upper bound for the absolute value of $\int_C \frac{e^z}{z+1}\,dz$ where C is the circle $|z| = 4$. — 5 Marks

d) Verify $u(x,y)=x^3-3xy^2-5y$ is harmonic in the entire complex plane. Then find the conjugate harmonic function of u. — 5 Marks

Problem number (2) (15 Marks)

a) Evaluate the integral $\int_c \frac{z-2}{z^2-z}\,dz$, where C is the contour shown in Figure(1): — 5 Marks



Figure(1)

b) Evaluate the integrals: — 10 Marks

1- $\int_c e^{\frac{-1}{2z}}\,dz$ over the contour $c: |z|=1$.

2- $\int_0^{2\pi} \frac{\cos 3\theta}{5-4\cos\theta}\,d\theta$.

3- $\int_0^{\infty} \frac{x\sin x}{x^2+9}\,dx$.

Problem number (3) (20 Marks)

a) Find all possible Taylor and Laurent series expansions of $f(z)=\frac{-1}{(z-1)(z-2)}$, specify the region of convergence of each of the above series. — 10 Marks

b) Find the general solution of the following differential equation: — 10 Marks

$$(x^2+1)y''-4x\,y'+6y=0.$$

Problem number (4) **(15 Marks)**

a) Prove that 9 Marks

1) $J_{-k}(x) = (-1)^k J_k(x)$ 2) $J_{1/2}(x) = \sqrt{\dfrac{2}{\pi x}}\sin x$

3) $\dfrac{d}{dx}\left(xJ_k(x)J_{k+1}(x)\right) = x\left[J_k^2(x) - J_{k+1}^2(x)\right]$

b) Find the general solution of the following differential equations: 6 Marks

$$x^2 y^{(2)}(x) + xy^{(1)}(x) + (x^2 - \lambda^2)y(x) = 0, \quad \lambda = \frac{4}{9}.$$

With my best wishes

Dr. Waheed Kamal Zahra and the committee

TANTA UNIVERSITY
DEPARTMENT OF COMMUNICATIONS
ELECTRONIC CIRCUITS (2)
SECOND TERM EXAM

FACULTY OF ENGINEERING
2^{ND} SEMSTER, 2^{ND} YEAR, 19-6-2014
TIME: 3 HOURS
TOTAL MARKS: 90

Answer the following questions

Question (1)

(a) Define the following terms: (6)

(Feedback – Frequency stability – Gain-bandwidth tradeoff)

(b) Compare between the positive feedback and the negative feedback. (6)

(c) A feedback amplifier with 5% negative feedback is designed to have overall gain of 20 dB. Calculate the open loop gain of the amplifier. If the above amplifier is arranged for current feedback voltage error and its input and output resistances are 100 KΩ and 100 Ω respectively. Calculate the new input and output resistances after feedback is introduced. (6)

Question (2)

(a) Why the oscillators are preferred over the alternators? (6)

(b) What is meant by: Piezo-electric effect? (3)

(c) Draw the common base Colpitts oscillator. (3)

(d) A Hartley oscillator circuit having two identical inductors which are designed to resonate in parallel with a variable capacitor that can be varied from CL pF to 400 pF. Determine the values of etch inductor and CL if the lower frequency of oscillation and the Hartley oscillator bandwidth are 300 kHz and 200 kHz respectively. (6)

Question (3)

(a) Compare between the different types of multivibrator. (6)

(b) Explain-with draw- the idea of operation of the Schmitt trigger circuit? (6)

(c) For the astable multivibrator, prove that the frequency of oscillation is determined by: (6)

$$f = \frac{1}{\ln(2).(R_2C_1 + R_3C_2}$$

Question (4)

(a) Compare between the classes of RF power amplifier (A, AB, B, C, and D) in a table. (6)

(b) For a class B amplifier using a supply of 30 V and driving a load of 16 Ω. Determine the maximum input power, output power, and transistor dissipation. (6)

(c) Calculate the efficiency of a transformer-coupled class A amplifier for a supply of 20 V and outputs of :

(i) V (p) = 20 V.

(ii) V (p) = 10 V.

(iii) V (p) = 5 V. (6)

Question (5)

(a) Compare between the On-Off control and In-Phase control techniques of ac voltage controllers. (6)

(b) State the applications of AC Voltage Controllers. (6)

(c) A single phase full wave ac voltage controller working on ON-OFF control technique has supply voltage of 230 V, RMS 50 Hz, load = 50 Ω. The controller is ON for 30 cycles and off for 40 cycles. Calculate: (6)

(i) ON & OFF time intervals.

(ii) RMS output voltage.

(iii) Average and RMS thyristor currents.

WITH BEST WISHES **Dr. Mohamed Salah**

Tanta University

Department: Computers and Automatic Control

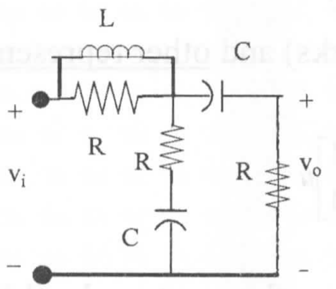
Faculty of Engineering

Total Marks: 70 Marks

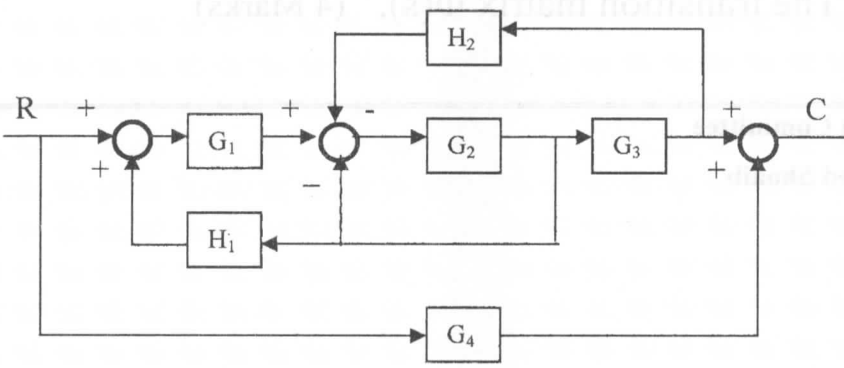
Course Title: Control Engineering	Course Code: CCE2251	Year: 2nd
Date: June 2014	Allowed time: 3 hrs	No. of Pages: (2)

Q1) a) The signals are classified into many groups. Write three groups of the signals and give an example for each (4 Marks), and explain the properties of the system and give an example for each(at least three). (4 Marks)

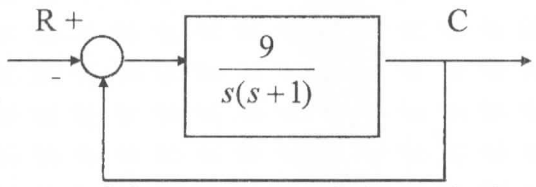
b) Find the mathematical model (transfer function) of the following system. (10 Marks)



c) Determine the transfer function using signal flow graph. (8 Marks)



Q2) [a] For the following system: (10 Marks)



1) Find the type of the system and the order?
2) Determine the natural frequency and damping factor?
3) Determine the steady state error for step input?

[b] For each of the following characteristic equations, find the root distribution and determine whether the system is stable, marginally stable, or unstable: (10 Marks)

i) $S^6+S^5+2S^4+2S^3+3S^2+2S+4=0$

ii) $S^7+3S^6+3S^5+S^4+S^3+3S^2+3S+1=0$

iii) $S^5+2S^4+2S^2+4S+5=0$

Q(3): For positive values of K, sketch the root locus for a unity negative feedback control system having the following open-loop transfer function:

$$G(s) = \frac{K}{(s-1)(s+3)(s+6)}$$

For what values of gain K does the system become unstable? (6 Marks)

Q(4):

[a] Find a state space model for a control system having the transfer function:

$$G(s) = \frac{(s+4)}{(s+5)}\frac{(s+7)}{(s^2+3s+6)}$$

in the pole-zero form (7 Marks) and other representation. (3 Marks)

[b] For the following system

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

$$y = \begin{bmatrix} 5 & 1 \end{bmatrix}\underline{X}$$

Find : 1) Determine whether the system in (b) is completely state controllable, observable and stable. (4 Marks)

2) The transition matrix Φ(s). (4 Marks)

Course Examination Committee

Dr: Mohamed Ahmed Shoaib

Course: **Electromagnetic Waves (1)**	Course Code: **EEC2208,**	Students: **2nd year**
Date: **Thu., 26-June-2014** ***(Second term),***	Time Allowed: **Three hours,**	No. of Pages: **2,**

Final Exam

(Total marks: 85 Marks)

Answer the following questions:

Problem 1: **(15 marks)**

a) State the Maxwell's equations in the point and integral forms.

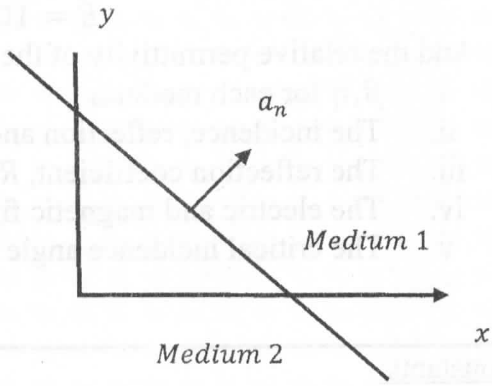
b) Drive the wave equations that represents the field components for a wave traveling through a source free medium.

c) If the magnetic field $H = \frac{E_m}{\eta} e^{j(\omega t - \beta z)}.a_x$. Find all other electric and magnetic field components in a source free medium with permeability μ_r and permittivityϵ_r. Find the direction of propagation for that wave.

Problem 2: **(15 marks)**

a) Drive the relation between tangential and normal components of the electric and magnetic fields at the boundary between two dielectric media.

b) Two dielectric media, which are interfaced as shown in the figure. If the magnetic field in the first medium is $H_1 = 0.3a_x - a_y + 0.3a_z$ and the electric field in the second medium is $E_2 = 1.2a_x + 7.5a_y$. Find all the fields in the two media if $\sigma_1 = \sigma_2 = 0, \epsilon_{r_1} = 10, \epsilon_{r_2} = 30, \mu_{r_1} = 0.5\mu_{r_2} = 2$.



Problem 3: **(20 marks)**

a) Obtain the parameters: α, β, η, skin depth (δ), the phase velocity (v_{ph}), and group velocity (v_g) for a wave propagating in a good dielectric medium then, write down the wave equations for each case.

b) An electric field of a plane wave with the value $E(y,t) = 5 \times 10^{-5} e^{-\alpha y}.\cos(0.2\pi \times 10^9 t + \beta y)$ is propagating in a medium with $\sigma = 5 \times 10^{-6}\ \Omega^{-1}/m$, $\epsilon_r = 300$.

i. Determine if the medium where the wave propagates is a good dielectric or good conductor.

ii. Find the range of frequencies that change the behavior that is obtained in (i).

iii. Evaluate $\alpha, \beta, \eta, \delta, v_g, v_{ph}$ and then find H.

iv. Find the Poynting vector in this medium.

Problem 4: (15 marks)

a) What is meant by the wave polarization? What are its types? Drive the equations relating the magnitude of electric field components for each type.

b) An electric field is propagating in a medium that is found to be,

$$E(x,t) = 4\times10^{-3}e^{-6x}\cos(5\pi\times10^{9} - 10\pi x)\, a_y + E_o e^{-\alpha x}\cos(\omega t - kx + \theta_o)\, a_z$$

i. Find the type of the medium and σ, ϵ_r. Consider $\mu_r = 1$.

ii. Find E_o, θ_o if:

1. The wave is linearly polarized and inclined by 40^o on the y-axis
2. The wave is circularly polarized
3. The wave is elliptically polarized

Problem 5: (20 marks)

a) Drive expressions for the reflection and transmission coefficients for a plane wave that is traveling through an interface between two dielectric materials (consider $\sigma = 0$ for the two dielectrics). Consider that the incident wave is linear perpendicular polarized.

b) A linear perpendicular polarized wave travels through two dielectric media ($\sigma = 0, \mu_r = 1$ for each). They are interfaced at the $x - z$ plane. The first dielectric occupies the $+ve\ y - direction$, while the second dielectric occupies the $-ve\ y - direction$. The plane-wave travels from the first to the second dielectric. If the incident electric field:

$$\vec{E} = 10^{-6}\times e^{j(6\pi\times10^{8}t - 4\pi x + 9\pi y)} a_z \;\; V/m$$

And the relative permittivity of the second medium is 300. Find

i. β, η for each medium
ii. The incidence, reflection and transmission angles.
iii. The reflection coefficient, R, and transmission coefficient, T.
iv. The electric and magnetic fields for the incident, reflected and transmitted waves.
v. The critical incidence angle that cause total reflection.

Constants:
Permeability of free space, $u_o = 4\pi\times10^{-7} H/m$,
Permittivity of free space, $\epsilon_o = \frac{1}{36\pi}\times10^{-9}\ F/m$.

With best wishes of success

Dr. Sameh A. Napoleon