ثانية اتصالات

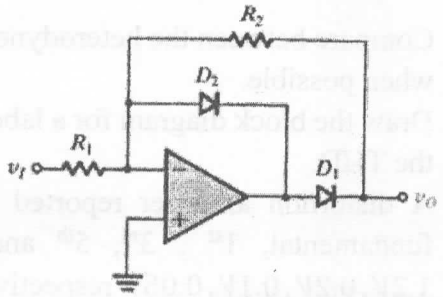
قياسات الكترونية (١)

Tanta University	Department of Electronics and Electrical Communication Engineering	Faculty of Engineering
Course Title: **Electronic Measurements (1)**	Course Code:EEC2105,	Students: **2nd year.**
Date: **Sat.,06-Jan.-2018,**	Time Allowed: **3 hours,**	No. of Pages: **2**
	Total Marks: **90**	
	Final Exam	

Remarks: (answer the following questions… assume any missing data … arrange your answer booklet … Use graphs and examples whenever you have a chance during your answer)

Question 1: (20 Marks)

a- Analyze the circuit shown to find its function. If its input is $v_I = 10 \sin \omega t \ \ mV$ and $R_2 = 2R_1$.



i. Sketch its output
ii. Sketch its output if D_2 replaced by a short circuit
iii. Sketch its output if D_1 , D_2 are inverted.
iv. Sketch its output if only D_2 is inverted.
v. Sketch its output if only D_1 is inverted.

b- Design a first order active band stop filter with voltage gain of 10 and a lower cut-off frequency of 100 Hz and higher cut-off frequency of 1.5 KHz. Draw the circuit and sketch its frequency response.

c- Draw a precision instrumentation full wave rectifier and indicate how it works. If the input signal is $v_I = 10 \sin \omega t \ \ mV$, compare its output to a bridge full wave rectifier.

Question 2: (20 Marks)

a- Draw the basic structure of the electromagnetic flowmeter transducer. Show how it measure the flow velocity. List the advantages of it.

b- Compare the different temperature transducers. Put your answers in a table.

c- For a certain thermistor, $\beta = 3100\ K$. Its resistance at $30^o C$ was 1200 Ω. If it was inserted into a liquid, and its measured resistance was 2440 Ω, find the temperature value of that liquid. If it is replaced by a resistance thermometer with $\alpha = 0.05$ and its resistance at $30^o C$ was 1200 Ω, what is its resistance at the temperature found by the thermistor?

Question 3: (20 Marks)

a- A digital signal is presented by $5V$ for logic 1 and $-5V$ for logic 0. Construct a 4-bits summing type DAC and a 4-bit R-2R ladder DAC using 5 KΩ resistors. Find the output of each circuit for a digital input: 1001,1010.

b- Compare the ramp type ADC, the flash ADC and the dual slope ADC. Deduce which ADC type is suitable for digital multimeters.

Question 4: (15 Marks)

a- Draw a circuit for generating square/triangle waveforms test signals for laboratory.

b- Draw a phase shift oscillator based on OpAmp that has all the resistors in the feedback network are set to 12 $K\Omega$ and all capacitances are set to 2.7μF. Find: (i) the frequency of oscillation, (ii) the condition for oscillation, (iii) If the available resistors for adjusting the gain of the amplifier are 15 $K\Omega$, 33 $K\Omega$, 220 KΩ and 470 $K\Omega$, choose the right values for assuring the existence of oscillation

c- A Hartley oscillator has $L_1 = 3L_2$, $C = 10nF$. Draw the circuit and find L_1, L_2 for generating a frequency of 1.2 MHz and the required amplifier gain.

Question 5: (15 Marks)

a- Compare between the heterodyne- and window- type wave analyzers. Include the block diagrams when possible.

b- Draw the block diagram for a laboratory harmonic distortion analyzer and explain how it measure the THD.

c- A distortion analyzer reported that the THD of a signal is 12% and it contains only the fundamental, 1st , 3rd, 5th and 7th harmonics. If the *rms* value of the harmonics are $1.2V, 0.2V, 0.1V, 0.05V$ respectively. Find the rms value of the fundamental frequency. Suggest a method to reduce the THD of that signal.

The end of questions

Use only black or blue pens or pencils in your answer
Do not make any mark in your booklet

Good luck .

Dr. Sameh A. Napoleon (Coordinator of the Course)

Tanta University Department: Electronics and Communications Eng. Faculty of Engineering

Course Title: Technical Reports	Course Code: EEC21H3	Second Year
Date: 15/01/2018	Allowed time: 2 hr	No. of Pages: (1)

Answer the following Questions:

1. **What are the main contents of the reports' body?**
2. **Mention the strategies for successful proposals.**
3. **Compare between the informal and formal emails?**
4. **Address the types of the technical writing.**
5. **State whether the following sentence would be classified as either formal or informal. If informal, change it to formal.**
   A. I am pleased to inform you that you have won our grand prize.
   B. I hope all is well with your new career choice.
   C. I shouldn't have gone and missed with it!!
   D. I can't help you with that cuz it's too hard.
   E. Hi, how are you?
6. **Identify the contents of the title page with an example.**
7. **Give examples for the Tree Diagram for effective writing?**
8. **Define the word 'citation' and how to cite references within the text and in the references list?**
9. **Structure the Table of contents for a review article titled 'Electronics in Medical Devices'.**
10. **What are the restrictions (what to avoid) while writing an abstract?**
11. **Define the word 'APPENDIX' and when it can be used?**
12. **Address the general guidelines for Graphs and Tables.**
13. **Write a maintenance technical report for the Electronic laboratory in the Electronics and Electrical Communications Engineering Department.**
14. **Write the following reference in the correct format:**
    (5 (226), Effect of Obesity on Albino Rat Kidney, WS Mohamed, AS Ashour, 2016).

Best Wishes

Dr. Amira Salah Ashour

Tanta University
Faculty of Engineering

17/1/2018

(2017-2018) PME2110
Second year (2nd com.)

Q (1) (25M)

(a) Fitting the curve on the form $y = \frac{e^{2x}}{ax^2+b}$ form

x	1	2	3	4	5
y	2	6	8	9	12

(b) Find the root of equation $\cosh x + x - 2 = 0$ by use the following methods

(i) Secant method (ii) Newton – Raphson method (iii) Lagrange method

(c) From directional encoding for digital image of curve starting at (0,0) and represent by the sequence of codes 7077 .

(i) Represent these codes graphically in xy-plane.

(ii) From its Coordinate find linear spline interpolation form.

Q (2) (25M)

(a) From the following table find f(0.11),f(0.65) and f(0.35)

x	0.1	0.2	0.3	0.4	0.5	0.6	0.7
f(x)	5	3	4	7	5	6	4

(use Gauss forward and Newton's methods)

(b) From the following table

x	0.01	0.02	0.03	0.04	0.05	0.06	0.07
F(x)	0.2	0.6	0.8	0.9	1.2	2.1	3

find: (ii) f '(.01) , f ''(.05) and f '(.07)

(iii) $D_{3,3}$ (Ricardson extrapolation) where $D_{1,1}$ = f '(.04)

Q (3) (25M)

(a) Deduce the form of truncation error and the form of trapezoidal integration rule.

(b) Find an approximate value of $\int_0^1 \frac{dx}{1+e^{x^2}}$ by using

(i) Trapezoidal rule (ii) Simpson rule (iii) Weddles rule

(vi) Gaussian two-point (v) Find $R_{3,3}$ (Romberg algorithm)

(c) Let δ, ∇, Δ *and* D be forward .backward, center and derivative operators. Show that $D = \frac{2}{h} \cosh^{-1}\left(\sqrt{1+\frac{\delta^2}{4}}\right)$

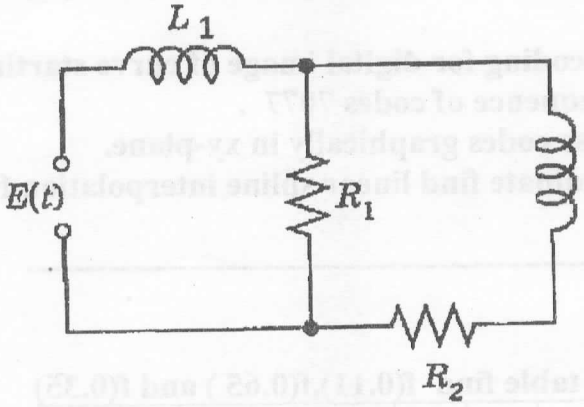
Q (4) (25M)

(a) Use Shooting method to find $y(0.6)$, $h=\frac{1}{3}$ and $0 \le x \le 1$ for

$$y'' + x^2 y' + y = x$$

where $y(0) = 0$ and $y'(1) = 1$

(b) Find the current I(t) at t=0.6 by numerical approximations method in the following network with R_1=5 ohms, R_2=4 ohms, L_1=0.2 henry, L_2=0.5 henry which connected to a source of voltage E(t) = 100 cos (200t). Assume that current and charge are zero when t=0 use h=0.2



(c) Use finite difference method to find the solution of one dimension heat equation $4u_t - u_{xx} = 0$, with boundary conditions u(x,0)=x sin πx, u(0,t)=1, u(2,t)=0 and $0 \le x \le 2$

With my best wishes

Dr: M.Shokry

ثانية اتصالات

Tanta University | Department: Electronics & Electrical Communications | Faculty of Engineering

Total Marks: (90) Marks

Course Title: Electronic Circuits (1)	Course Code: EEC2103	Year: 2017/2018
Date:13/1/2018	Allowed time: (3) hrs.	No. of Pages: (4)

Question No. 1 : [10 Marks]

Choose the correct answer to complete the sentences

1. **A change in frequency by a factor of _____is equivalent to 1 octave.**
   a. 2
   b. 10
   c. 5
   d. 20

2. **What is the ratio of the capacitive reactance X_{CS} to the input resistance R_I of the input RC circuit of a single-stage BJT amplifier at the low-frequency cutoff?**
   a. 0.25
   b. 0.50
   c. 0.75
   d. 1

3. **For which of the following frequency region(s) can the coupling and bypass capacitors no longer be replaced by the short-circuit approximation?**
   a. Low-frequency
   b. Mid-frequency
   c. High-frequency
   d. All of the above

4. **The_____region produces the maximum voltage gain in a single-stage BJT or FET amplifier.**
   a. low frequency
   b. mid frequency
   c. high frequency
   d. none of the above

5. **The decibel gain of a cascaded system is the _____ of the decibel gains of each stage.**
   a. sum
   b. difference
   c. product
   d. quotient

6. **In the input RC circuit of a single-stage BJT or FET amplifier, as the frequency _____, the capacitive reactance _____ and _____ of the input voltage appears across the output terminals.**
   a. increases, decreases, more
   b. increases, decreases, less
   c. increases, increases, more
   d. decreases, decreases, less

7. **The _____ of the upper cut-off frequencies defines a _____ possible bandwidth for a system.**
   a. highest, maximum
   b. lowest, maximum
   c. lowest, minimum
   d. None of the above

8. **Maximum efficiency produced by class B amplifier is approximately_____.**
   a. 50%
   b. 60%
   c. 79%
   d. 84%

9. **In a class C amplifier_____.**
   a. Efficiency and distortion both are maximum
   b. Efficiency and distortion both are minimum.
   c. Efficiency maximum but distortion minimum.
   d. Efficiency minimum but distortion maximum

10. **Effect of voltage-shunt feedback connection is_____**
    a. increasing the input impedance and decreasing the output impedance.
    b. increasing the input impedance and increasing the output impedance.
    c. decreasing the input impedance and decreasing the output impedance.
    d. decreasing the input impedance and increasing the output impedance.

Question No. 2: [10 Marks]

Complete the following sentences:

1. The maximum efficiency of resistance loaded class A power amplifier is_____.
2. In class B operation, the operating point is generally located _____ of the d.c. load line.
3. Class C amplifiers are used as _____.
4. If a transistor is operated in such a way that output current flows for 60° of the input signal, then it is a class_____operation.
5. The collector efficiency of a power amplifier having zero signal power dissipation of 5 watts and a. c. power output of 2 watts is _____.
6. A transformer coupled class A power amplifier has a load of 100 Ω on the secondary. If the turn ratio is 10:1, then the value of load appearing on the primary is _____.
7. Power amplifiers generally use transformer coupling because transformer permits_____.
8. Quasi-complementary push–pull transformerless power amplifier has two pairs: Darlington and_____.
9. If an amplifier with gain of -1000 and feedback of $\beta = 0.1$ has a gain change of 20% due to temperature, then the change in gain of the feedback amplifier equals_____.
10. If the gain of the amplifier without feedback is *A*, then with feedback β the overall gain of the circuit is reduced by a factor_____.

Question No. 3: [20 Marks]

1. Refer to the class AB amplifier shown in Fig. 1

a. For V_i = 5 V rms, determine the power delivered to the load resistor.
b. Draw the load line for the npn transistor.
c. Label the saturation current, Ic(sat), and show the Q-point.

2. For the circuit shown in Fig. 2

a. Determine the low-cutoff frequency.
b. Sketch the asymptotes of the Bode plot.

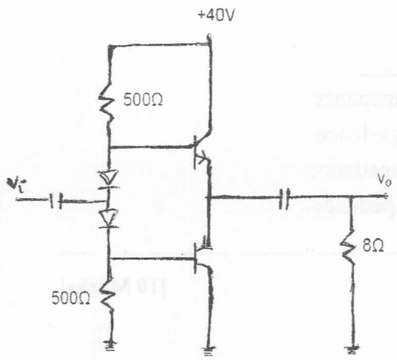


Fig.1

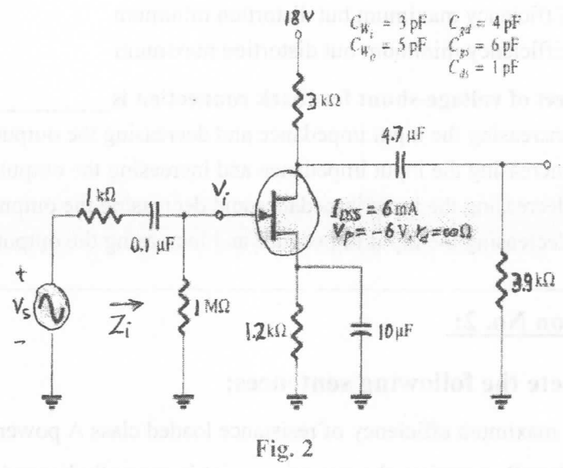


Fig. 2

Question No. 4: [20 Marks]

1. **For the circuit shown in Fig. 3**, drive a symbolic expression for v_o as a function of i_{s1} , i_{s2}, R_1, R_2, R_3 and R_4.

2. For the circuit shown in Fig.4:

a. Calculate the single-ended output voltage Vo.
b. Derive an expression for the common-mode gain of the amplifier circuit.
c. Explain with drawing how we can improve this circuit by using constant current source.

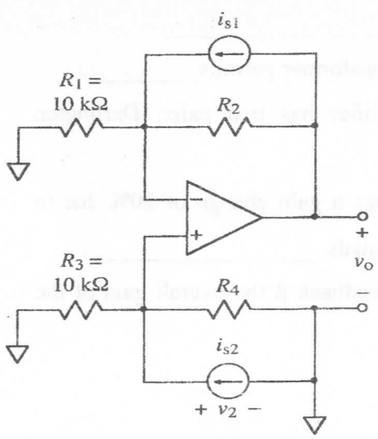


Fig. 3

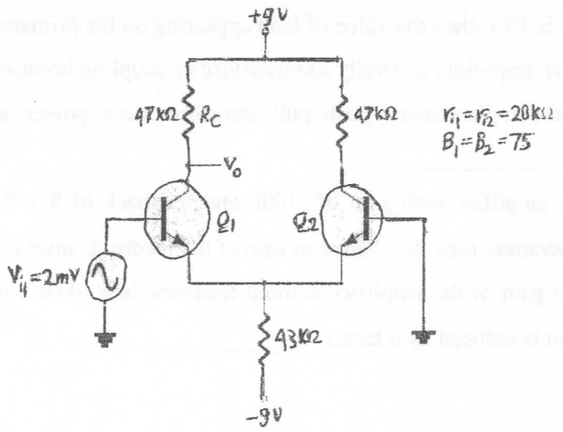


Fig. 4

Question No. 5: [30 Marks]

1. For the circuit shown in Fig. 5: [10 Mark]

a. Calculate the total offset voltage for an op-amp with specified values of input offset voltage V_{IO} = 4 mV and input offset current I_{IO} = 150 nA.
b. Calculate the input bias currents at each input of the op-amp if the average bias current I_{IB} = 30 nA.

2. For the signal and circuit of Fig. 6 , determine the maximum frequency that may be used. Op-amp slew rate is SR = 0.5 V/μs. [5 Marks]

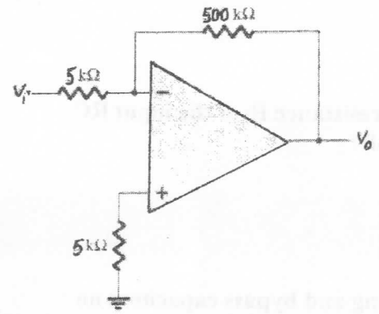


Fig. 5

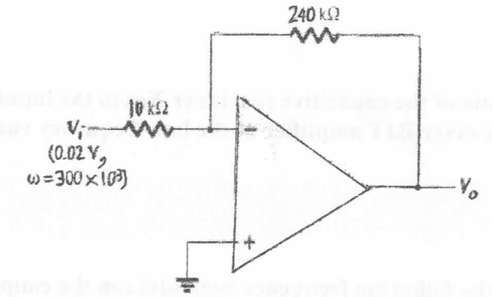
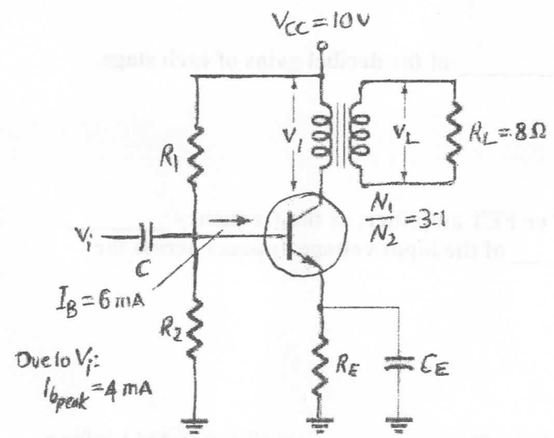


Fig. 6

3. Determine the output voltage of an op-amp for input voltages of V_{i_1} = 150 μ V and V_{i_2} = 140 μV. The amplifier has a differential gain of A_d = 4000 and the value of CMRR is 100. [5 Marks]

4. Explain how the operational amplifiers can be used to form various types of controlled sources. [5 Marks]

5. Calculate the ac power delivered to the 8-Ω speaker for the circuit of **Fig. 7**. The circuit component values result in a dc base current of 6 mA, and the input signal (*Vi*) results in a peak base current swing of 4 mA. [5 Marks]



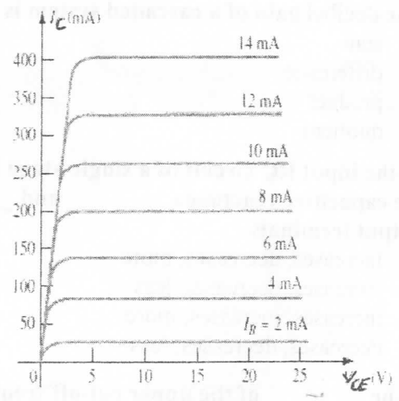


Fig. 7

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End of Questions

Best wishes of success

Dr. Roayat Ismail (Coordinator of the Course)

d. State the main concept of detection of an FM signal, then explain the demodulation of a frequency modulated signal using a simple high pass filter discriminator. [6 Marks]

أذكر الفكرة الرئيسة للكشف عن إشارة FM، ثم اشرح بالتفصيل دائرة استعادة التعديل لإشارة تعديل التردد باستخدام المميز البسيط بواسطة مرشح تمرير مرتفع.

Best Wishes
Dr. Mahmoud A. A. Ali

Course Examination Committee
Associate Prof. Mahmoud A. A. Ali
Associate Prof. Amr Hussain Hussain Abdallah
Dr. Sameh Atif Napoleon
Dr. Heba Ali El[Khoppy

Course Coordinator: Associate Prof. Mahmoud A. A. Ali

Electronics and Electrical Communications Engineeing Dept.
Final Exam: Total 100 Marks
Tanta University
Faculty of Engineering

Course Title: Communication Theory	Course Code: EEC 2104	Year: 2nd
Date: First Term 3/1/ 2018	Allowed Time: 3 Hours	No. of Pages: (2)

Answer the following Questions

Question No 1 [20 Marks]

a. Assume that the signal $f(t)$ is given as follows: بفرض أن الإشارة الزمنية تعطى كما يلي: [5 Marks]

$$f(t) = 2\left[rect\left(\frac{t-10}{2}\right) + rect\left(\frac{t+10}{2}\right)\right]\cos\omega_c t$$

- Sketch this signal in time domain. ارسم هذه الإشارة في النطاق الزمني.
- Obtain its Fourier transform and draw it. أوجد تحويل فورير لها ثم ارسمه.
- Find its spectral density, then indicate whether it is an energy or power signal and why.

ثم استنتج الكثافة الطيفية لها، ثم وضح هل هي إشارة طاقة أم إشارة قدرة مع توضيح السبب.

b. Comment on the importance and the usage of Fourier series and Fourier transform in communications. Support your comments by examples. [4 Marks]

ناقش أهمية ثم تطبيقات استخدام كل من متسلسلة فورير وتحويل فورير في الاتصالات. ثم دعم تعليقاتك بالأمثله.

c. Explain briefly the convolution property of the Fourier transform, then explain in details an application of its usage in analysis of a communication system [5 Marks]

اشرح بإيجاز خاصية الالتواء لتحويل فورير، ثم اشرح بالتفصيل تطبيقا لاستخدامه في تحليل أنظمة الاتصالات.

d. Define the natural meaning and the mathematical expression of the correlation process, and explain in detail how it can be used to suppress or to reduce the noise effect on receiving equipment's. [6 Marks]

قم بتعريف المعنى الطبيعي والتعبير الرياضي لعملية الترابط، ثم اشرح تفصيليا آلية استخدامها في حذف أو تقليل تأثير الضوضاء على أجهزة الاستقبال.

Question No 2 [20 Marks]

a. Define, explain the physical meaning, then indicate the mathematical and / or graphical representation each term of the following: [6 Marks]

قم بتعريف، وشرح المعنى المادي، ثم الإشارة إلى التمثيل الرياضي و/ أو الرسم البياني لكل مصطلح من الأمور التالية:

- Linear system. النظام الخطي.
- Time invariant system. النظام الثابت مع الزمن.
- Distortionless system. النظام الخالي من التشويه.

b. Explain the procedure to calculate the transfer function of a linear time invariant system for individual harmonics, then show how to measure it using a spectrum analyzer. [4 Marks]

اشرح آلية حساب دالة النقل للنظام الخطي الثابت مع الزمن وذلك للتوافقيات الفردية، ثم بين كيفية قياسها باستخدام محلل الاطياف.

c. Define the rise time indicating its importance in designing of communication systems. Then prove how to determine the rise time for a low pass filter using a simple RC circuit.[5 Marks]

قم بتعريف زمن الارتفاع موضحا أهميته في تصميم أنظمة الاتصالات. ثم أثبت كيف يمكن تعيين زمن الارتفاع لمرشح تمرير منخفض باستخدام دائرة بسيطة مكونة من مقاومة ومكثف.

d. Write down with the aid of drawing an expression of ideal high pass filter according to the concepts of distortionless, prove its impulse response, and draw it then comment. [5 Marks]

اكتب مع الاستعانة بالرسم صيغة مرشح مرور مرتفع مثالي وفقا لمفاهيم التشويه، ثم إثبت استجابته للنبضة، ثم ارسمه مع التفسير.

Question No 3 [20 Marks]

a. Express the general mathematical relations that represent the following modulation techniques in the time domain: [5 Marks]

كيف يمكنك كتابة الصيغ الرياضية العامة التي تمثل طرق التعديل التالية في النطاق الزمني:

$$f_{DSB.SC}(t), f_{DSB.TC}(t), f_{SSB.SC}(t), f_{VSB}(t), f_{NBPM}(t), f_{NBFM}(t), f_{WBFM}(t)$$

b. From the expressions of the time domain that you have just wrote in part a, deduce the mathematical expressions of the spectrum of the following modulation techniques. [5 Marks]

طبقا لتعبيرات المجال الزمني التي كتبتها للتو في الجزء أ استنتج الصيغ الرياضية للطيف لتقنيات التعديل التالية:

$$F_{DSB.SC}(\omega), F_{DSB.TC}(\omega), F_{SSB.SC}(\omega), F_{NBPM}(\omega), F_{NBFM}(\omega), F_{WBFM}(\omega)$$

c. Draw the spectrum of the following modulation techniques assuming that the modulating signal $f(t)$ as a sinusoidal function of amplitude A_m equals one half of the carrier amplitude A_c whereas its frequency ω_m is one tenth of the carrier frequency ω_c: . [5 Marks]

ارسم طيف تقنيات التعديل التالية بافتراض أن إشارة التعديل كدالة جيبية اتساعها نصف اتساع الموجة الحاملة في حين أن ترددها عُشْر تردد الموجة الحاملة:

$$F_{DSB.SC}(\omega), F_{DSB.TC}(\omega), F_{SSB.SC}(\omega), F_{NBPM}(\omega), F_{NBFM}(\omega), F_{WBFM}(\omega)$$

d. If the carrier is given as $A_c \sin \omega_c t$, sketch precisely the output of the following modulation techniques in time domain assuming that the modulating signal $f(t)$ as a symmetric periodic rectangular function of amplitude A_m equals one half of the carrier amplitude A_c whereas its fundamental frequency ω_m equals one tenth of the carrier frequency ω_c: [5 Marks]

إذا كانت الموجة الحاملة إشارة جيب، ارسم بدقة خرج طرق التعديل التالية في النطاق الزمني بفرض أن إشارة التعديل هي عبارة عن موجات مربعة دورية ومتماثلة، بحيث أن اتساعها يساوي نصف اتساع الموجة الحاملة بينما ترددها الرئيس يساوي عُشْر تردد الموجة الحاملة:

$$f_{DSB.SC}(t), f_{DSB.TC}(t), f_{PM}(t), f_{FM}(t)$$

Question No 4 [20 Marks]

a. Sketch and explain and the phase shift method to generate the single side suppressed carrier amplitude modulated signal $f_{SSB.SC}(t)$. [4 Marks]

ارسم واشرح طريقة ازاحة زاوية الطور لتوليد إشارة تعديل السعة ذو الجانب الواحد مع حذف الموجة الحاملة.

b. Draw and explain the general block diagram of AM Radio transmitter then draw the spectrum of the signal at the output of each stage. [5 Marks]

ارسم ثم اشرح المخطط الصندوقي العام لمرسل تعديل السعة لموجات الراديو، ثم ارسم شكل الطيف عند مخرج كل مرحله من مراحله.

c. Explain in details how to change the unmodulated carrier to obtain a general expression of the frequency modulated signal $f_{FM}(t)$ showing its instantaneous phase and frequency. [5 Marks]

اشرح بالتفصيل كيفية تغيير الموجة الحاملة غير المشكلة للحصول على تعبير عام لإشارة تعديل التردد موضحا طورها وترددها اللحظي.

d. Illustrate the specifications of the standard FM audio broadcasting for public, the frequency range allocated for it, number of stations, and the bandwidth for each station. [5 Marks]

وضح مواصفات البث السمعي القياسي للجمهور بنظام FM والنطاق الترددي المخصص له، وعدد محطاته، بالإضافة إلى تحديد عرض نطاق الإشارة لكل محطة.

Question No 5 [20 Marks]

a. Explain what is meant by the Bessel function, the form of integration that it expresses and its type, and what is the mechanism for determining the frequency band of wide band frequency modulation system through the values of its coefficients. [4 Marks]

وضح ما هو المقصود بدالة بسل وما شكل التكامل الذي تعبر عنه ونوعه وما هي آلية تحديد النطاق الترددي لنظام تعديل التردد بنطاق واسع من خلال قيم معاملاته.

b. Explain the physical meaning of the linearity of modulation. State the condition of linearity. Apply this condition on the following techniques: [4 Marks]

اشرح المعنى الطبيعي لخطية التعديل. ثم اذكر شرط الخطية. ثم قم بتطبيق هذا الشرط على التقنيات التالية:

$$f_{DSB.SC}(t), f_{DSB.TC}(t), f_{NBPM}(t), f_{WBFM}(t)$$

c. Explain in details the direct method to generate the wide band frequency modulated signal indicating its basic concept in addition to its practical circuit for realization. [6 Marks]

اشرح بالتفصيل الطريقة المباشرة لتوليد إشارة تعديل التردد الواسع النطاق مع الإشارة إلى مبدئها الأساسي بالإضافة إلى الدائرة العملية التي يمكن استخدامها.

مجالات كهروضاطيسيه ثانية اتصالات

Tanta University
Faculty of Engineering
Electrical Power and Machines Engineering Dept.

Final Exam – First Semester 2017-2018

Course: EPM2104/EPM2141(Electromagnetic Fields)	**Time allowed**: 3 hr.
Year: 2nd Electrical Power/Communications	**Date**: 10 Jan 2018
No. of Pages: 3 — **No. of Questions:** 5	**Total Score:** 85

Remarks: Attempt to solve all of the following questions

Part-I Electrostatic Fields

Question 1 — **15 Points [10+5]**

[A] SOLVE AND CHOOSE the correct answer for the following statements:

(Verification of your choice is A MUST when numerical data are given)

لن تحتسب الإجابة صحيحة اذا لم تكن مقرونه بالحل فى حالة أن تكون المعطيات رقمية

(1) Plane z = -10 m carries charge -20 nC/m². The electric field intensity at the origin is

(a) $-10a_z$ V/m (b) $-18\pi a_z$ V/m (c) $-72\pi a_z$ V/m (d) $-360\pi a_z$ (e) None

(2) Point charges 30 nC, -20 nC, and 10 nC are located at (-1,0,2), (0,0,0), and (1,5,-1), respectively. The total flux leaving a sphere of radius 6 m centered at the origin is:

(a) 20 nC (b) -10 nC (c) 10 nC (d) 30 nC (e) None

(3) A potential field is given by $V = 3xy - 5y$. Which of the following is <u>not</u> true?

(a) The potential difference between point (2, -1, 4) and point (2, -1, -4) is zero.

(b) At point (1, 0, -1), E vanish.

(c) The electric field at (2, -1, 4) is $3a_x - a_y$ V/m.

(d) The potential at (0, 1, 0) is -5 V.

(e) None of the above.

(4) Which is not an example of convection current?

(a) Electric current flowing in a copper (b) A beam of moving charges

(c) Electronic movement in a vacuum tube (d) An electron beam in cathode ray tube

(5) A capacitor connected to a battery stores energy twice as much with a given dielectric as it does with air. The susceptibility of the dielectric is

(a) 0 (b) 2 (c) 1 (d) 3 (e) None

[B] State true (√) or false (×) and correct the false statements

لن تحتسب الإجابة صحيحة اذا لم تكن مقرونه بالتصحيح فى حالة أن اختيار (×) وبالتعليل فى حالة اختيار(√)

(1) The dielectric strength is the minimum electric field that a dielectric can withstand without breakdown.

(2) Inside a conductor, the electric field intensity is changes with the position.

(3) A dielectric is an equipotential body.

(4) For a free-charged dielectric-dielectric interface, the tangential components of the electric flux density in the two materials are equal.

(5) The charges can be either be created nor be destroyed.

Question 2 — **15 Points (3X5)**

A. A circular disc of charge with radius a lies in free space in the z = 0 plane, centered at the origin and has a uniform charge density of ρ_{so} C/m².

(a) What is the total charge of the disc

(b) Find the electric field intensity at point A(0,0,h)

(c) Find the electric potential at point A

(d) For $\rho_s = \pi\varepsilon_o$ C/m² and a = 4 m. Calculate the magnitude of field intensity at points P_1(0,0,3) and P_2(0,0,-6)

(e) For $\rho_s = \pi\varepsilon_o$ C/m² and $a \to \infty$. Calculate the magnitude of field intensity at P_1 and P_2.

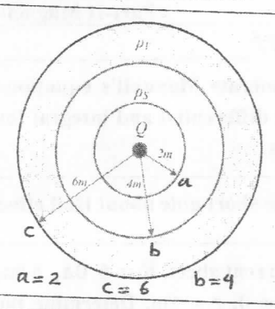
B. Starting with Gauss's law, deduce coulomb's law.

C. Consider the following charge distribution:

- a point charge of 10μC is located at r = 0, and
- a uniform surface charge density of $-1\mu C/m^2$ at r = 2

a) Calculate the electric flux density D at r =1 and r = 3

b) What uniform volume charge density should be established in the region 4 <r< 6 for D to vanish at r=7.



Question 3 — **20 Points (2X10)**

A. **Let $V = 10xy$, V in free space.**

(i) What is the volume charge density?

(ii) Determine the potential difference between A(1,2,3) and B(1,3,5) (two methods)?

(iii) Calculate the work done needed to move a unit positive charge from point A to point B?

(iv) What is the work done needed to move a point charge in a rectangular loop taking path (1,0,0)→(1,2,0) →(1,2,1) →(1,0,1) →(1,0,0)? Discuss your result?

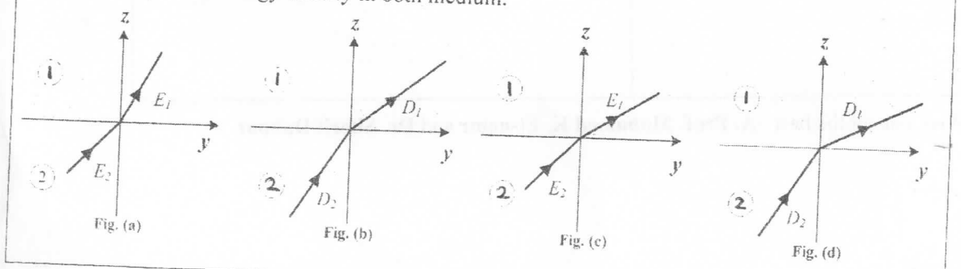
(v) Assume that the $y = 0$ plane is a conductor and find the total charge on $2 < x, z < 3$.

B. The following figure shows the representations of electrostatic fields near a dielectric-dielectric boundary for different medium.

(a) Which configuration(s) are correct for $\varepsilon_{r1} < \varepsilon_{r2}$?

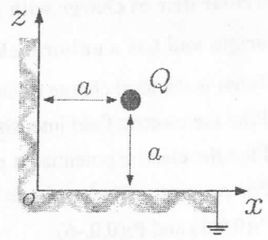
(b) If $\vec{E} = 5\hat{a}_x + 2\hat{a}_y + 3\hat{a}_z$ V/m in medium 2 and $\varepsilon_{r2} = 2\varepsilon_{r1} = 2$, then determine:

1) The electric flux density in medium 1.
2) The polarization for each medium.
3) The energy density in both medium.

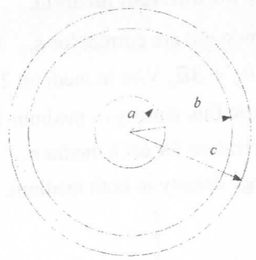


Question 4	Extra Points (BONUS)	5 Points

A point charge Q=10 nC in Fig. is $10\sqrt{2}$ cm away from the origin. The charge is located between two semi-infinite conducting planes as shown.



(a) What is the number of charge images?
(b) Sketch the electric field lines and the equipotential surfaces in the system.
(c) Calculate the magnitude of the force on Q due to the charge induced on the conducting walls.

Part-II Magnetostatic Fields and Time varying fields		
Question 5		35 Points
a)	Enumerate Maxwell's equations for steady magnetic field and static electrical field in both differential and integral forms. Explain the modifications required for time varying fields.	
b)	Write short note about Hall effect and how it can be used for current sensing.	
c)	A current sheet, $\bar{K} = 6.0\hat{a}_x$ A/m, lies in the $z = 0$ plane and a current filament is located at $y = 0$, $z = 4$m. Determine the filament current I and its directions, if H = 0 at (0, 0, 1.5) m.	
d)	A current filament carrying 15A in the $\hat{a}_z$direction lies along the entire z-axis. Find $\bar{H}$ in rectangular coordinates at (2, -4, -4).	
e)	For a rectangle loop laying in xy-plane, the loop opposite corners are (0, 0, 0) and (1, 2, 0). It carries a filamentary current of 4mA. The current is going out the origin along x-direction. If the loop is subjected to the magnetic field $\bar{B}_o = -0.6\hat{a}_y + 0.8\hat{a}_z$T, calculate the torque established on the loop.	
f)	Find the current density vector causing the magnetic field strength $\bar{H} = xyz(\hat{a}_x + \hat{a}_z)$.	
g)	Express the value of $\bar{H}$ in Cartesian components at P(0.01, 0, 0) m in the field of coaxial cable a = 3mm, b = 9mm, c = 12mm, I = 0.8A, centered on the z-axis, $\hat{a}_z$ direction is into the central conductor.	

Wish you all the best **A. Prof. Mohamed K. El-nemr** and **Dr. Sherif Dabour**