ثانية اتصالات مادة تحليل الإشارات

كلية الهندسة
بحلوان

Dept/Division : *Comm., Electronics. & Computers/Comm. division*
Academic level: *Second* **Semester:** *First 2015/16*
Course code & title: *Signal Analysis*
Instructor: *Prof. Dr. Ihab Ali & Dr. Samir Swedan*
Total mark: *100 marks* **Time allowed:** *3 hrs*

جامعة حلوان

Part - I

Question (1): ....(18 marks)

(a) State the expression for:

i- Orthogonal condition of two aperiodic signals $\mathbf{g_1(t)}$ and $\mathbf{g_2(t)}$.

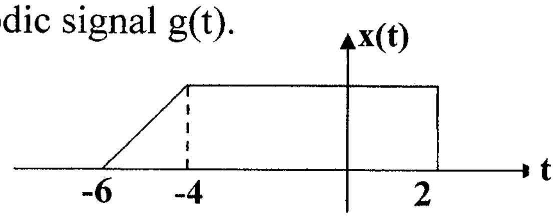
ii- **r(t)** as a function of **unit step** function.

iii- The correlation coefficient between two signals **x(t)** and **g(t).**

iv- The relationship between power spectral density PSD and the autocorrelation function of a periodic signal g(t).

(b) Given the signal *x(t),* find and sketch the transformed signal

$$y(t) = x(-2t + 1)$$



(c) Given the continuous –time (CT) signal $\mathbf{g(t) = e^{(-a+jb)t}}$

i- Sketch the signal g(t) when **a = 1** and **a = 0**

ii- Determine the total energy $\mathbf{E_g}$ and the av. power $\mathbf{P_{av}}$ of g(t) when **a = 0**

(d) Find and sketch the Fourier Transform of the convolution

$$\text{rect}\left(\frac{t}{T}\right) * \text{rect}\left(\frac{t}{T}\right)$$ (Use the convolution property)

Question (2): ....(16 marks)

(a) Let $\mathbf{g(t) = \delta(4t)}$.

Is this signal band-limited? (Justify your answer).

(b) Find the Fourier Series coefficients D_n's of the continuous signal

$$\mathbf{g(t) = 1 + 3\cos \pi t}$$

(c) Let **x(t)** be a CT signal with Fourier Transform **X(ω)**

i- Drive an expression for the Fourier Transform of $\mathbf{y(t) = x(t - t_o)}$

ii- If **x(t) = rect (t/τ)**, sketch **X(ω)** and **Y(ω)**, then <u>comment on your results.</u> (without justification)

Question (3): ....(16 marks)

Given a low pass signal $\mathbf{g(t) = e^{-at}}$ $(t \geq 0)$

(a) Sketch **g(t).**

(b) Find the time autocorrelation function $\mathbf{R_g(\tau)}$, (for positive τ).

(c) Using autocorrelation function, determine the energy spectral density **ESD** of the signal **g(t).**

(d) If the essential bandwidth is required to contain **95%** of the signal energy, estimate the essential bandwidth of the signal **g(t)**

[Hint: $\int \frac{1}{x^2 + a^2}\, dx = \frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right)$]

من فضلك اقلب الصفحه

Part II: Random Signal Analysis:

Q.4 (20 Marks)

a. Determine the auto-correlation function and power spectral density of the random signal $X(t) = A\cos(\omega_c t + \emptyset)$, where $\emptyset$ is a random variable uniformly distributed over $(0, 2\pi)$.

b. Determine the auto-correlation function and the power of the low pass random process with power spectral density $S_x(\omega) = \begin{cases} N/2 & |\omega| \leq 2\pi B \\ 0 & otherwise \end{cases}$. Calculate the signal power when N= 1 mW/Hz and B= 1 KHz.

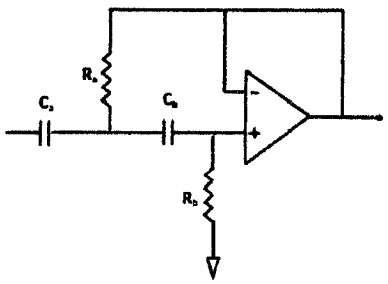
Part III: Filter Design

Q.6 (30 Marks)

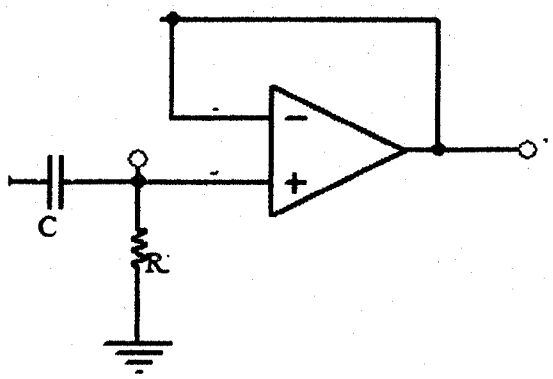
a- The magnitude of the transfer function of a normalized Butterworth Filter is given by $|H(j\omega)| = \frac{1}{\sqrt{1+(\frac{\omega}{1000})^6}}$. What are the values of the pass-band gain adjustment factor ϵ and the filter order n? Deduce the normalized transfer function H(S) of the given filter.

b- Given the transfer function of a normalized Butterworth Filter as $H(S) = \frac{1}{(S+1)(S^2+S+1)}$, deduce the un-normalized transfer function H(s) if the given filter is High-Pass with cutoff frequency 1 k rad./sec.

Realize the transfer function $H(s) = \frac{s^3}{(s+10^3)(s^2+10^3 s+10^6)}$ using the first and second order sections below by determining the circuit elements' values. Assume appropriate values for the extra design parameters.



Second order section



First order section

اقتصاد هندسي ثانية اتصالات ١٤/١/٢٠١٦

كلية الهندسة بحلوان

Department / Division : Electronics, Communications and computers
Academic level: Second **Semester:** First 2015-2016
Course code & title: MEC 2214, Engineering economy
Instructor: Dr. Araby Ibrahim
Total mark: 40 **Time allowed:** 2 hours

يسمح باستخدام كتيب الجداول والمعادلات للاقتصاد الهندسي ولكن لا يسمح بتبادلها او الكتابة فيها

Question 1 (8 Marks)

One method for developing a mine containing an estimated 100,000 tons of ore will result in the recovery of 62% of the available ore deposit and will cost $23 per ton of material removed. A second method of development will recover only 50% of the ore deposit, but it will cost only $15 per ton of material removed. Subsequent processing of the removed ore recovers 300 pounds of metal from each ton of processed ore and costs $40 per ton of ore processed. The recovered metal can be sold for $0.80 per pound. Which method for developing the mine should be used if your objective is to maximize total profit from the mine?

Question 2 (8 Marks)

2.1 The straight-line depreciation method is to be used for an asset with a cost of $78,000, an estimated salvage value of $12,000, and an estimated useful life of six years. Determine the depreciation schedule of that asset.

2.2 Tacozza Electric, which manufactures brush dc servomotors, budgeted $75,000 per year to pay for certain components over the next 5 years. If the company expects to spend $15,000 in year 1, how much of a uniform (arithmetic) increase each year is the company expecting in the cost of this part? Assume the company uses an interest rate of 10% per year.

Question 3 (10 Marks)

A manufacturer of hydraulic equipment is trying to determine whether it should use monoflange double block and bleed (DBB) valves or a multivalve system (MVS) for chemical injection. The costs are shown below. Use an incremental rate of return analysis and a MARR of 18% per year to determine the better of the two options. (The life of each option is 4 years)

	DBB	MVS
First cost, $	−40,000	−71,000
Annual cost, $ per year	−60,000	−65,000
Salvage value, $	0	18,000

من فضلك اقلب الصفحة

Question 4 (14 Marks)

4.1 An effective method to recover water used for regeneration of ion exchange resins is to use a reverse osmosis system in a batch treatment mode. Such a system involves recirculation of the partially treated water back into the feed tank, causing the water to heat up. The water can be cooled using one of two systems: a single-pass heat exchanger or a closed-loop heat exchange system. The single-pass system, good for 3 years, requires a small chiller costing $920 plus stainless steel tubing, connectors, valves, etc. costing $360. The cost of water, treatment charges, electricity, etc. will be $3.10 per hour. The closed-loop system will cost $3850 to buy, will have a useful life of 5 years, and will cost $1.28 per hour to operate. What is the minimum number of hours per year that the cooling system must be used in order to justify purchase of the closed-loop system? The MARR is 10% per year, and the salvage values are negligible.

4.2 Carlotta, the general manager for Woodsome appliance company Plant #A14 in Mexico City has 4 independent projects she can fund this year to improve surface durability on stainless steel products. The project costs and 12% per year PW values are available. What projects are acceptable if the budget limit is $50,000?

Project	Initial Investment, $	Life, Years	PW at 12% per Year, $
1	−15,000	3	−400
2	−25,000	3	8500
3	−20,000	2	500
4	−40,000	5	7600

كلية الهندسة بحلوان

Dept/Division: Elect. Comm. & computer Eng.
Academic level: Second **Semester:** First 2015/2016
Course code & title: : ELC 2213 / Electronic 3
Instructor: Dr/ Fathy Z. Amer & Dr. Zaky B. Nossier
Total mark: 120 marks **Time allowed:** 3 hrs

جامعة حلوان

Instructions: Solve each part in separated papers
Answer the following questions

Question1 (Mark 44)

1. a. The input stage of op amp is shown in Fig. 1. The reference current = 19 μA, transistors Q_1 to Q_6 are biased at I_C= 9.5 μA and all have β=250. The early voltages are 100V and 50V for npn and pnp transistors respectively. Determine the gain (V_O/V_d), the differential-input resistance (R_{id}), R_O, and CMRR. $I_S=10^{-14}$A. (Mark 19)

b. For the current source shown in Fig. 2, determine: (Mark 7)
i) I_{C1} and I_{C2} ii) The value of R_C so that V_O= 6V.

c. For the ideal class B push-pull amplifier, V_{CC}= 15V and R_L = 8 Ω. The input is sinusoidal. Determine (i) the maximum output signal power; (ii) the collector dissipations in each transistor; (iii) the conversion efficiency; (vi) What is the max. dissipations of each transistor, and what is the efficiency under this condition? (Mark 10)

d. A transistor has $T_{jmax} = 150^oC$ and capable to dissipating maximum power. The maximum power dissipation is to be derated linearly with $\Theta_{JC}= 3.12^oC/W$ and $\Theta_{JA}= 62.5^oC/W$. Find, i) The maximum power dissipation at $T_A = 50^oC$; ii) The maximum power that can be dissipated when the transistor is operated at $T_A = 50^oC$ but with a heat sink for which $\Theta_{CS}= 0.5^oC/W$ and $\Theta_{SA}= 4^oC/W$. Find the temperature of the case and of the heat sink; and iii)The max. power that can be dissipated if an infinity heat sink is used (Mark 8)

Question2 (Mark 16)

a. In the design of a particular Weien-bridege oscillatorr, the values of R_1 and C_1 are adjustable according to the relation $0.1 \le R_1/R_2 \le 10$ and $0.1 \le C_2/C_1 \le 10$. Find the minimum and maximum values of oscillation frequency for R_2= 10 KΩ and C_1 = 0.1 μF. (Mark 5)

b. The circuit shown in Fig. 3 can be used as a colpitts oscillator when $Z_1 = -jWC_1$, $Z_2 = -jWC_2$ and $Z_3 = JWL$. The current amplifier has an input resistance R_i, and $r_O= \infty$. Determine the frequency of oscillation and the value of A_i needed to sustain oscillation. (Mark 7)

c. For the limiter circuit of amplitude control of op amp oscillators shown in Fig. 4, find the lower and upper limits of output voltage. (Mark 4)

Fig. 4

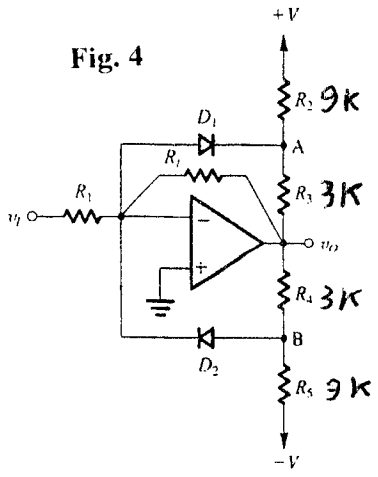


Fig. 2

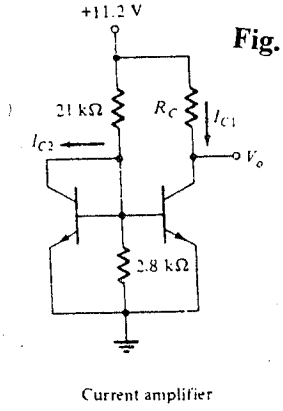


Fig. 3

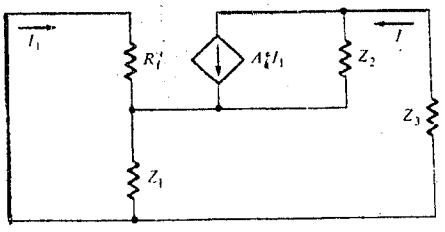
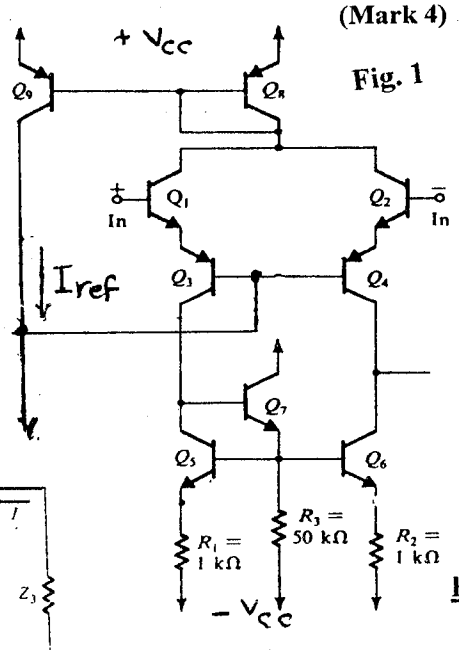


Fig. 1



P. T. O.

Question 3. (20 marks)

(a) State the advantages of the CMOS logic family over the TTL logic family.

(b) Draw the circuit diagram of a 2-input NMOS NAND gate and explain how it performs the NAND operation.

(c) Draw the circuit diagram of a 2-input CMOS NOR gate and explain how it performs the NOR operation.

Question 4. (20 marks)

For the TTL circuit shown in Fig. 1, assume the BJT parameters are $V_\gamma = 0.5$ V, $V_{BE(ON)} = 0.7$ V, $V_{BE(sat)} = 0.8$ V, $\beta_f = 70$, $\beta_r = 0.1$, and $V_{CE(sat)} = 0.2$ V,

(a) Find V_o when $V_1 = V_2 = 0.2$ V.

(b) Find V_o when $V_1 = 5$ V and $V_2 = 0.2$ V.

(c) What type of TTL gate is this circuit?

Question 5. (20 marks)

For the DTL gate shown in Fig. 2, assume the BJT parameters are $V_\gamma = 0.5$ V, $V_{BE(ON)} = 0.7$ V, $V_{BE(sat)} = 0.8$ V, $\beta_f = 70$, $\beta_r = 0.1$, and $V_{CE(sat)} = 0.2$ V. The diode cut-in voltage is 0.6 V and, when conducting, has a 0.7 V drop across it.

(a) Determine the noise margins of the circuit.

(b) Determine the fan-out. Assume the circuit is connected to similar gates.

(c) Determine the dissipated power P_L and P_H

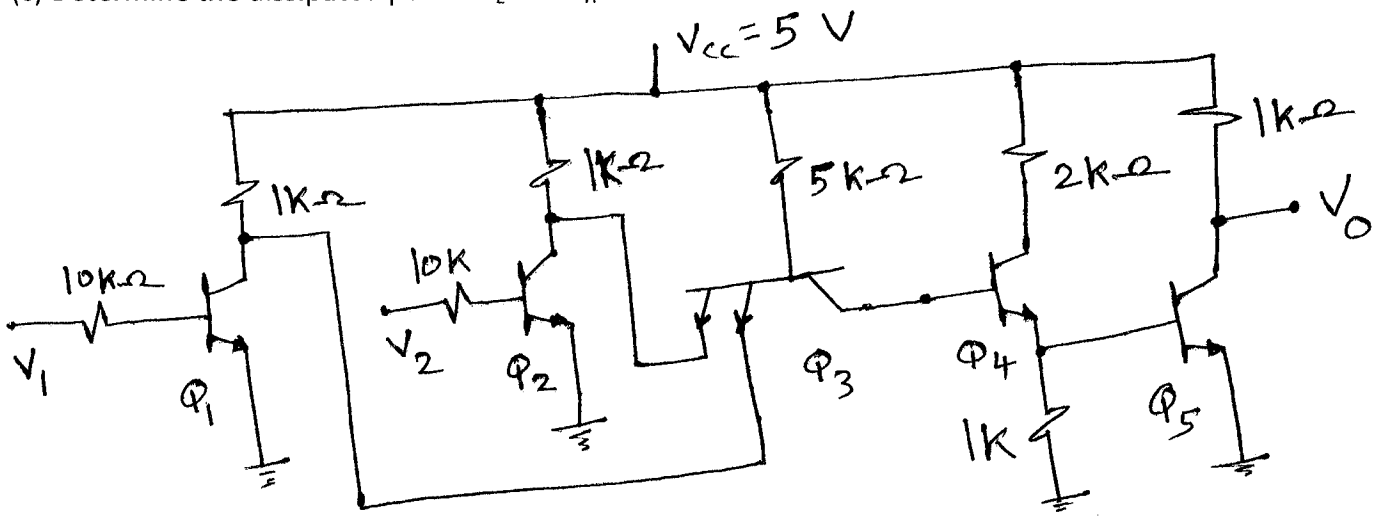


Fig. 1

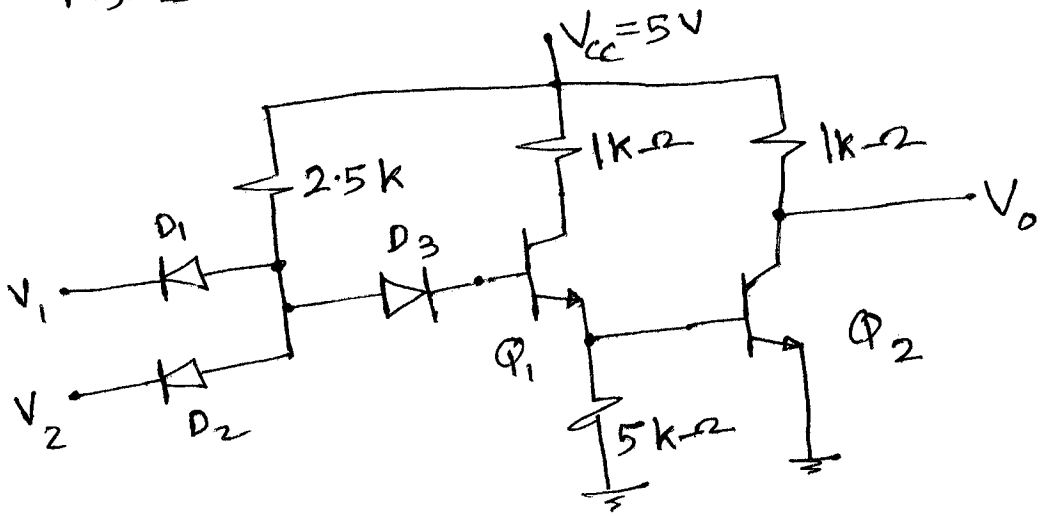


Fig. 2

Helwan University	Department:	Electronics, Communication and Computer Engineering.		Faculty of Eng. - Helwan
	Course Title:	Electrical Machines		
	Academic Level:	2nd Year B. Sc.	Semester: First 2015 / 2016	
	Course Code:	POW 2212	Total Mark: 90 marks	
	Instructor(s):	Dr. Ahmed R. Mahran and Dr. Refaat S. Ahmed		
	Date:	21/1/2016	Time Allowed: 3 Hours	

Answer the following questions

Question (1) *(13 marks)*

(A) Describe with sketch, *the field flux control* that can be used for the *speed control* of a dc motors.

(B) A dc series motor runs at 1000 r.p.m. when taking 20A at 200V. The resistance of the armature winding is 0.5 Ω and that of the field winding 0.2 Ω. Find the speed for a total current of 20A, 200V, when 0.2 Ω resistor is joined in parallel with the field winding. The flux for a field current of 10A is 70% of that for 20A.

Question (2) *(12 marks)*

(A) *Explain briefly*, with *sketch*, (T-I_a) characteristics of a compound and series dc motor.

(B) A 500V, shunt motor takes a total current of 5A when running on no-load. The resistance of armature circuit is 0.25 Ω and the field resistance is 125 Ω. Calculate the efficiency and output when the motor is loaded and taken a current of 100A.

Question (2) *(20 marks)*

(A) *Explain briefly*, with *sketch*, the external characteristics (V_L-I_L) of a compound and shunt dc generator.

(B) A 2-poles series motor runs at 707 r.p.m. when taking 100A at 85V and with the field coils in series. The resistance of each coil is 0.03 Ω and that of the armature resistance is 0.04 Ω. If the field coils are connected in parallel and load torque remain constant, find :

(1) The speed when the field coils are connected in parallel,

(2) The additional resistance to be inserted in series with the motor to restore the speed to 707 r.p.m.

P.T.O

Question (4) **(10 marks)**

(a) For ideal transformer, if the mutual flux in the transformer core is given by $\Phi = \phi_m \sin \omega t$, Prove that the rms value of the induced voltage in the secondary windings equal to $E_2 = 4.44\, f\, N_2 \phi_m$.

(b) A 150 kVA, 2400/240 V, single-phase transformer has the following parameters:

R_{eq1} =0.4 Ω, X_{eq1} =0.9 Ω, R_{C1} = 10 kΩ, X_{M1} =1.6 kΩ.

The transformer load current is 625 A at secondary voltage 240 V and 0.8 pf lag.

(1) Compute the primary voltage at this condition.
(2) Compute the core loss and the copper loss at this condition.
(3) Find the primary current when the transformer at no load.
(4) If the primary voltage 2400 V and a short circuit occurs at the secondary terminals, compute the primary current.

Question (5) **(15 marks)**

(a) A 400/100 V single-phase transformer, the primary and secondary winding resistances are 0.5 and 0.005 respectively. If the primary winding feeding from a DC source of 20 V, and the secondary winding is short circuit, what are the primary and secondary currents?

(b) 10 kVA, 2200/ 220 V, 60 Hz, single-phase transformer, has the following data.

O. C. T (HV windings open circuit):	220 V,	2.5 A,	100 W
S. C. T (LV windings short circuit):	150 V,	4.55 A,	215 W

(1) Find the parameters of the approximate equivalent circuit referred to the high voltage side, and draw this circuit.
(2) If the primary voltage is 2200V and rated load current with 0.8 p.f. lag, find the secondary voltage.
(3) Find the full load voltage regulation at 0.8 pf lag.
(4) Compute the full load efficiency at 0.8 pf lag.
(5) Compute the max efficiency at unity power factor.

Question(6) **(20 marks)**

(a) Draw the torque-speed characteristic of 3-ph IM at different voltages.
(b) What are the methods of speed control of 3-ph induction motors?
(c) A 3-phase, 50 hp, 440 V, 60 Hz, 4 pole, 3-phase induction motor, has the following parameters of approximate equivalent circuit:

$R_1 = 0.1\ \Omega$, $X_1 = 0.35\ \Omega$, $R'_2 = 0.12\ \Omega$, $X'_2 = 0.4\ \Omega$,
$R_C = 160\ \Omega$ $X_m = 14\ \Omega$

The core losses are 1200 W and the rotational losses are 950 W. If the motor operates at slip 0.025, Determine:

(1) Rotor current. (2) Stator current (3) developed power
(4) Motor efficiency. (5) Output Torque (6) Full load output power.

مع تمنياتنا لكم بالتوفيق والنجاح