FNU FIJI NATIONAL UNIVERSITY

College of Engineering, Science and Technology (CEST)

SCHOOL OF ELECTRICAL & ELECTRONIC ENGINEERING

ADVANCED DIPLOMA IN ENGINEERING (ELECTRICAL & ELECTRONICS)

EEE606 – CIRCUITS & SIGNALS

Wednesday 30th May, 2013 0900 - 1210 hours Venue: C301

INSTRUCTIONS TO CANDIDATES

1. Candidates are reminded that they should have no books, notes, paper or other material in their possession unless their use is specifically permitted by "Instructions to Candidates" set out below.
2. Reading time is of 10 minutes duration.
3. Examination time is of 3 hours duration.
4. Write your candidate number at the top of each attached sheet.
5. This paper consists of two (2) sections: A and B.
6. Attempt ALL four (4) questions in Section A and one (1) out of four (4) questions in Section B.
7. Each question carries 20 marks.
8. The following sets of Table are provided: Laplace Transform; Fourier Transform, Standard Integrals, and Trigonometric Identities.
9. Matlab is also available for use.
10. Cellphones are not allowed inside the examination venue.

SECTION A

This section is compulsory and all questions are to be attempted.

QUESTION 1: THEVENIN THEOREM; NORTON THEOREM; SUPERPOSITION THEOREM

Q 1 - 1: Thevenin Theorem

Consider the frequency domain network in Figure 1.

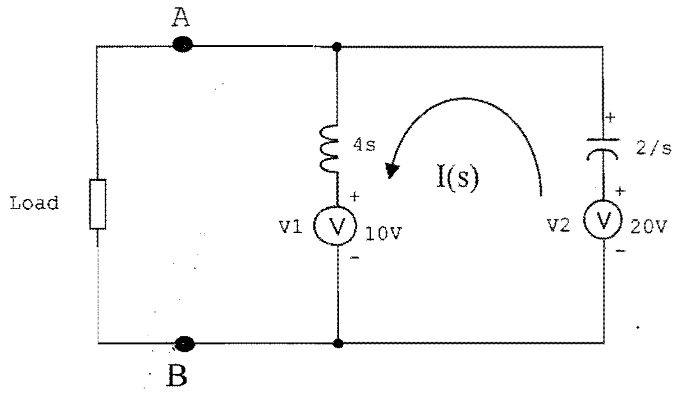


Figure 1: Frequency Domain Network

(a) Condense the network to the right of terminals A and B, to its Thevenin equivalent circuit, thus obtaining V_{Th} and Z_{Th}. **[6 marks]**

(b) Determine the short-circuit current when A is connected to B. **[3 marks]**

Q1 - 2: Norton Theorem

Refer to Figure 1.

(a) Reduce the network to the right of terminals A and B to its Norton equivalent circuit. **[4 marks]**

Q1 - 3: Superposition Theorem

(a) **Refer to Figure 2. Determine I_1, I_2, and I_3 using the Superposition theorem.** **[7 marks]**

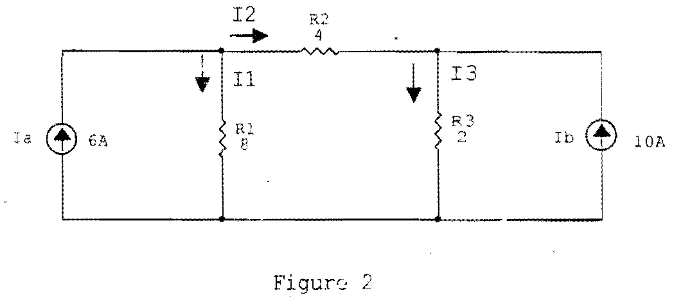


Figure 2

[TOTAL = 20 MARKS]

QUESTION 2: RLC NETWORK MODELLING & LAPLACE TRANSFORMS APPLICATION

Q2 - 1: Analyze the *RLC* Series circuit shown in Figure 3. The output is taken across the resistor, *R*. Assume zero initial conditions.

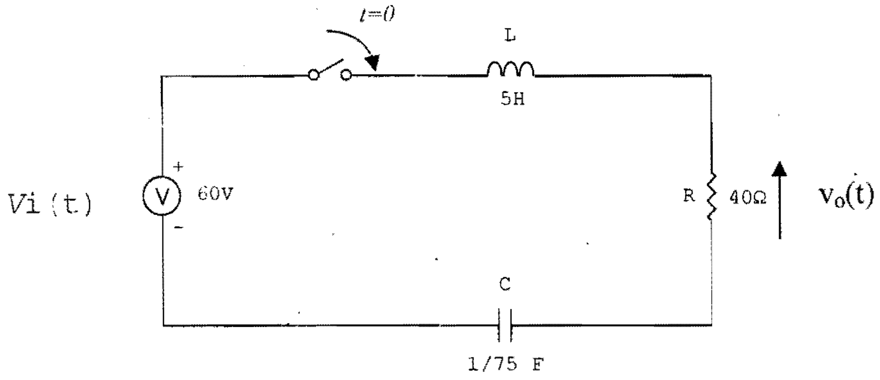


Figure 3

(a) **Derive the Second Order Differential Equation model of the system using Kirchoff's Voltage Law (KVL).** **[2 marks]**

(b) **Transform the Differential Equation from time domain to s-domain using Laplace Transforms, to obtain $Q(s)$** **[5 marks]**

(c) **Determine $q(t)$ from the $Q(s)$ obtained in (b).** **[3 marks]**

(d) Express the mathematical model as a first order Differential Equation.
[2 marks]

(e) Determine the Laplace transformed circuit using any suitable method.
[3 marks]

(f) Solve for the Transfer Function, G(s), when output is taken across *R*.
[3 marks]

(g) Identify, with reason, the type of damping in the system. **[2 marks]**

[TOTAL = 20 MARKS]

QUESTION 3: FOURIER SERIES, FOURIER TRANSFORM & CONVOLUTION

Q3 – 1: A periodic current waveform is given by, $i(t) = \begin{cases} 20, & 0 \le t < 2 \\ 0, & 2 \le t < 4 \end{cases}$ **Amps,**

and $i(t+4) = i(t)$.

(a) **Sketch 3 periods of the function i*(t)* and label clearly.** **[2 marks]**

(b) **Determine the coefficients a_o, a_n, and b_n.** **[4 marks]**

(c) **Synthesize the first 3 terms of the Fourier series of *v(t)*.** **[4 marks]**

Q3 - 2: Fourier Transform & Convolution

(a) **Derive the Fourier Transform of the following systems using the Fourier Transform table.**

(i) $y(t) = 2u(t)\cos 3t$ **[2 marks]**

(ii) $q(t) = u(t)e^{-2t}\cos(9t)$ **[2 marks]**

(b) **Using the Convolution Theorem,** $h(t) = (f * g)(t) = \int_0^t f(\tau)g(t-\tau)d\tau$,

determine the inverse, *h(t)*, of the function,

$$H(s) = \frac{12}{s^2+36} \bullet \frac{s}{s^2+25}$$ **[6 marks]**

[TOTAL = 20 MARKS]

QUESTION 4: OPERATIONAL AMPLIFIERS, FILTERS, ANALOGUE COMPUTERS

Q4 – 1: With the circuit given, determine V_0, I_1 and I_0. [3 + 2 + 2 = 7 marks]

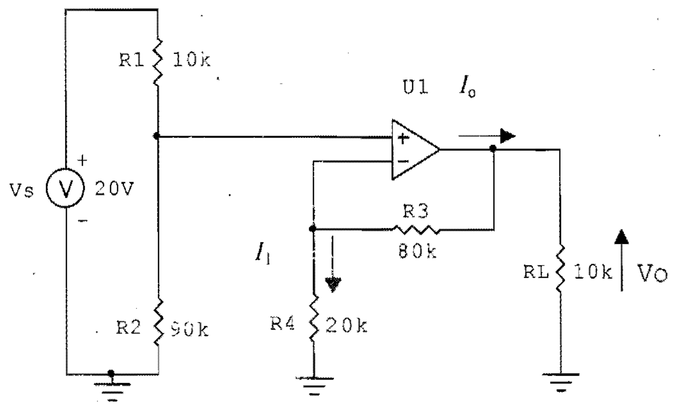


Figure 4

Q4 - 2: Design a mathematical analogue computer to solve the second order differential equation, $q'' = -6q' - 3q + 4\sin 5t$, using Operational amplifiers. Use Integrators whose time constant RC = 1s. The initial conditions are q'(0) = 0 and q(0) = 1. State any assumptions you make and provide a brief explanation on each step of the design. [6 marks]

Q4 – 3: The operational amplifier in Figure 6 is configured to control frequency response and acts as a Band Pass Filter. Determine the Transfer Function, H(ω), and identify the Low Pass and High Pass components.

[7 marks]

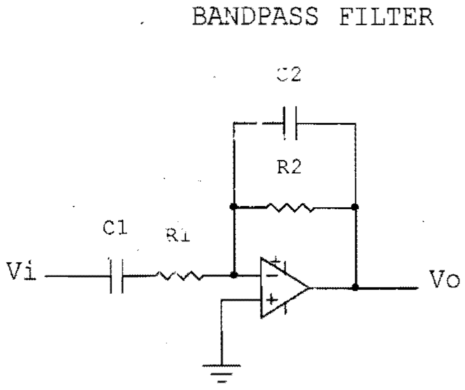


Figure 5: Band Pass Filter

[TOTAL = 20 MARKS]

SECTION B

Answer only one (1) question in Section B. Please note that this means either Question 5, Question 6, Question 7, or Question 8.

QUESTION 5: LOOP ANALYSIS & NODAL ANALYSIS

Q5 - 1: Loop Analysis

1. **Consider Figure 5, shown. Use Loop (Mesh) analysis to determine currents I_1, I_2, I_3, and I_0.** **[10 marks]**

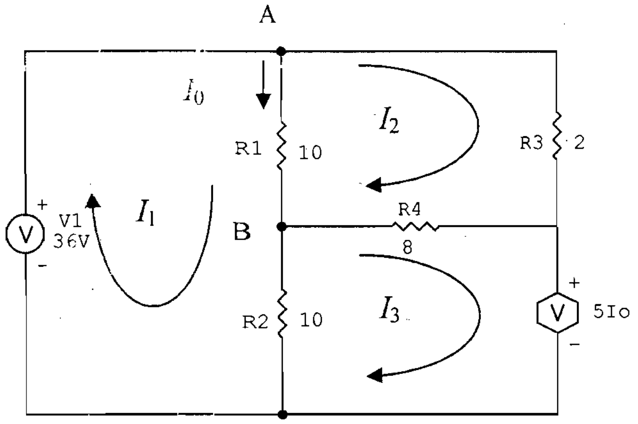


Figure 6

Q5 - 2: Nodal Analysis

Consider Figure 6 below.

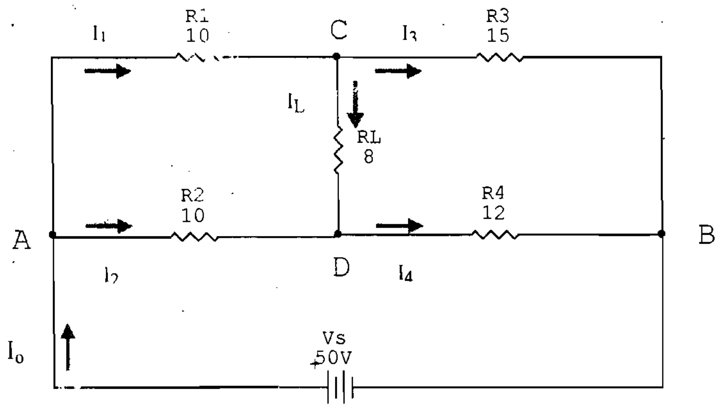


Figure 7

(a) Use Nodal Analysis to determine V_C and V_D **[8 marks]**

(b) Determine the load current, I_L. **[2 marks]**

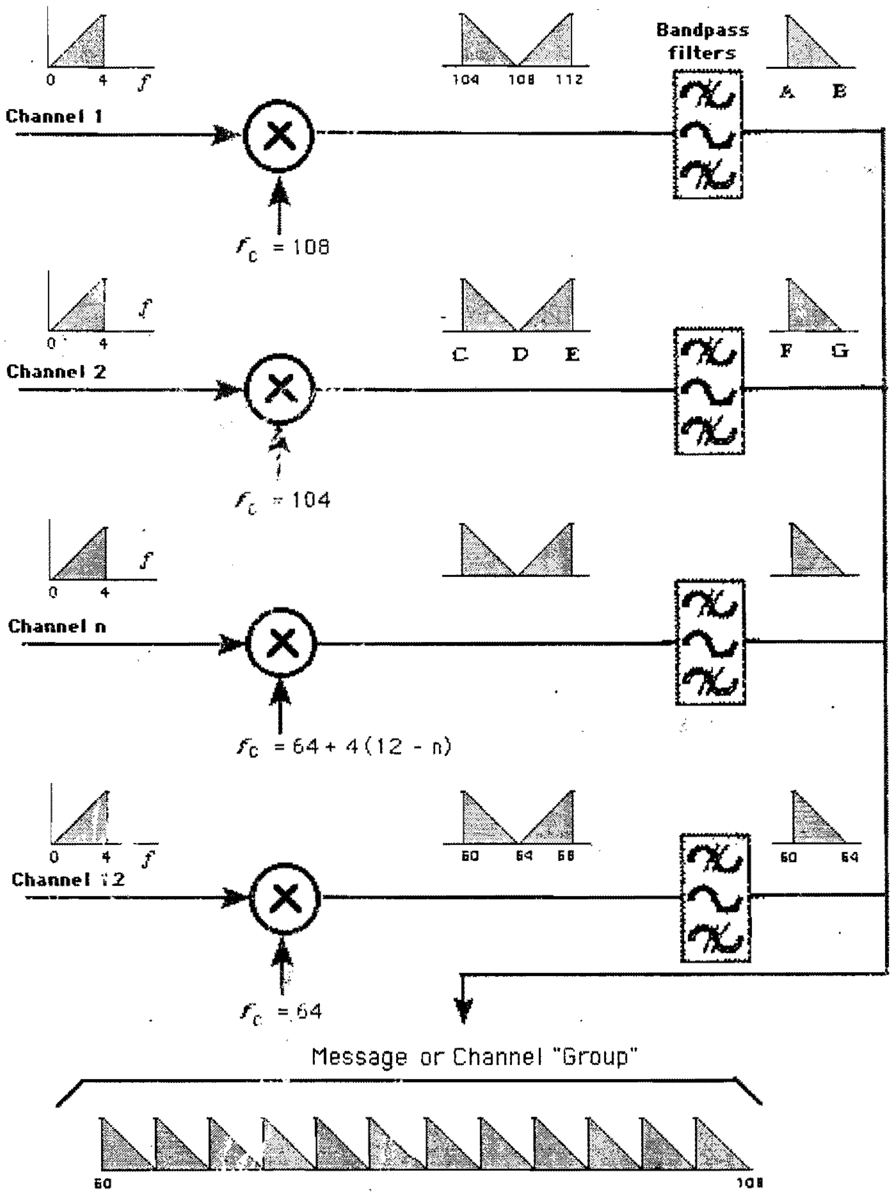
[TOTAL = 20 MARKS]

QUESTION 6: MULTIPLEXERS, FILTER,

Q6-1: Multiplexing

(a) Explain the term *Multiplexing* briefly. You may use a diagram to assist you. [2 marks]

(b) The diagram in Figure 7 shows a schematic of multiple voice channels aggregated into a channel or message group by using Frequency Division Multiplexing (FDM). Complete the diagram by deducing the values for A, B, C, D, E, and F. [4 marks]



Note: All frequencies values are in kHz

Figure 8

(c). Refer to Table 1, showing the Function Table for the Binary Adder. Design a circuit using the 74LS153 Multiplexer to implement the Sum (S) and the Carry (C). Both outputs S and C are to be present at any time. (Note: Datasheet for 74LS153 is provided).

A	B	K	S	C
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Table 1: Binary Adder

[8 marks]

Q6 – 2: The operational amplifier is configured as an Integrator and also a Low Pass Filter in Figure 5. Determine the Transfer Function, H(ω).

[6 marks]

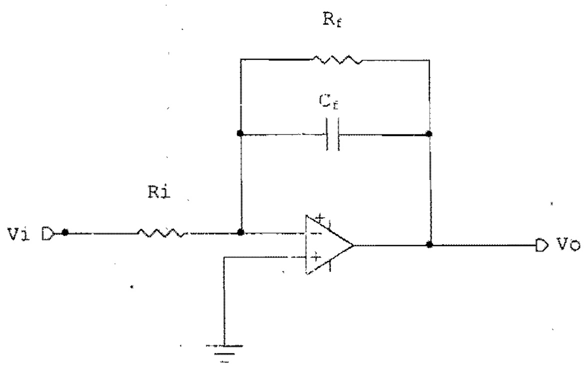


Figure 9: Integrator and Low Pass Filter

QUESTION 7: SECOND ORDER DIFFERENTIAL EQUATIONS & RLC NETWORK MODELLING APPLICATION

Q7-1: Analyze the *RLC* network shown in Figure 9. The output is taken across the capacitor, *C*. Assume zero initial conditions.

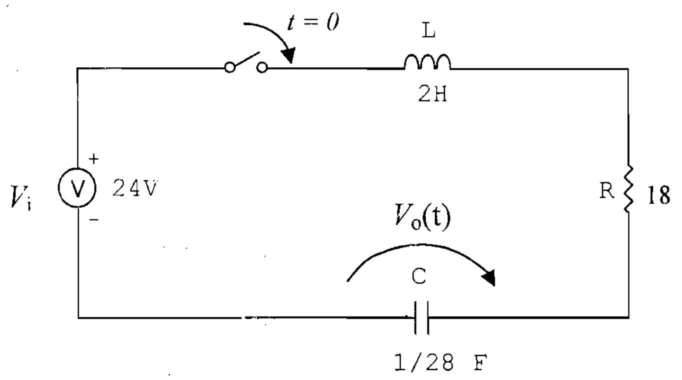


Figure 10

Solve for the following:

(a) Characteristic (Auxiliary) Equation. [Hint: first find the Second Order Differential equation]. **[3 marks]**

(b) Characteristic Roots & Characteristic Modes. **[3 marks]**

(c) Complementary Function. **[2 marks]**

(d) Briefly explain the term "Zero Input Solution". **[2 marks]**

(e) Particular Integral. **[3 marks]**

(f) General Solution. **[2 marks]**

(g) Particular Solution. **[5 marks]**

[TOTAL = 20 MARKS]

QUESTION 8: COMMUNICATION SYSTEMS & APPLICATION OF FOURIER TRANSFORMS

Q8 – 1: From the Fourier Transform, we know that,

$$F\{\cos 2\pi f_C t\} = \frac{1}{2}[\delta(f - f_C) + \delta(f + f_C)].$$

Applying the Frequency Shifting property produces the Fourier Transform pairs,

$$g(t)e^{j2\pi f_c t} \Leftrightarrow G(f - f_c)$$

The Modulation Property of the Fourier Transform states that,

$$F\{g(t)\cos(2\pi f_C t)\} = F\left\{g(t)\left(\frac{e^{j2\pi f_C t} + e^{-j2\pi f_C t}}{2}\right)\right\} = \frac{1}{2}[G(f - f_C) + G(f + f_C)]$$

The block diagram of the AM Modulator is given in Figure 11 below.

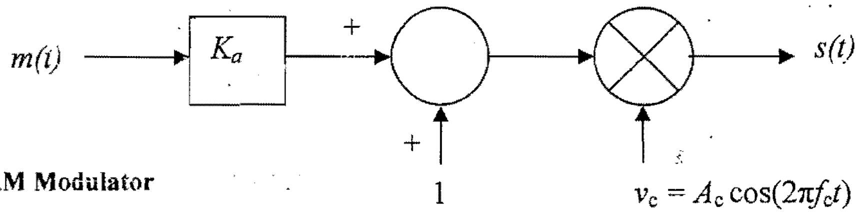


Figure 11: AM Modulator

Supplied are the following facts:

$m(t) = \cos(2\pi \times 5{,}000t)\,V, \quad v_c = 120\cos(2\pi \times 10^6 t)\,V$

(a) **Determine for the expression of the AM signal in the time domain, *s(t)*, given the general form** $s(t) = A_C[1 + k_a m(t)]\cos(2\pi f_C t)$ **. Assume** $k_a = 1$**.**

[3 marks]

(b) **Synthesize the formula for the AM signal in the Frequency domain, S(*f*), and substitute for the values of the modulating frequency and carrier frequency.**

[7 marks]

Q8 - 2: Given the AM signal, $s(t) = 250\left[1 + \left(\frac{25}{250}\right)\cos(2\pi \times 10^3 t)\right]\cos(2\pi \times 10^6 t)$ **Volts**

(i) Sketch the waveform of the AM signal, *v(t)*$_{AM}$. Label it appropriately. [3 marks]

(ii) Derive another equivalent equation of *s(t)*. [3 marks]

(iii)Sketch and label the Frequency Spectrum of *e(t)* as will be displayed on a Spectrum Analyzer. [2 marks]

(iv) Find the percentage modulation [2 marks]

[TOTAL = 20 marks]

[END OF EXAMINATION]

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TABLE OF LAPLACE TRANSFORMS

$F(s) = L[f(t)]$	$f(t), \quad t \geq 0$
1. 1	$\delta(t_0)$, Unit Impulse at $t = t_0$
2. $\frac{1}{s}$	1, Unit Step
3. $\frac{n!}{s^{n+1}}$	t^n
4. $\frac{1}{s+a}$	e^{-at}
5. $\frac{1}{(s+a)^n}$	$\frac{1}{(n-1)!}t^{n-1}e^{-at}$
6. $\frac{a}{s(s+a)}$	$1 - e^{-at}$
7. $\frac{1}{(s+a)(s+b)}$	$\frac{1}{(b-a)}\left(e^{-at} - e^{-bt}\right)$
8. $\frac{s+\alpha}{(s+a)(s+b)}$	$\frac{1}{(b-a)}\left[(\alpha - a)e^{-at} - (\alpha - b)e^{-bt}\right]$
9. $\frac{ab}{s(s+a)(s+b)}$	$1 - \frac{b}{(b-a)}e^{-at} + \frac{a}{(b-a)}e^{-bt}$
10. $\frac{1}{(s+a)(s+b)(s+c)}$	$\frac{e^{-at}}{(b-a)(c-a)} + \frac{e^{-bt}}{(c-a)(a-b)} + \frac{e^{-ct}}{(a-c)(b-c)}$
11. $\frac{s+\alpha}{(s+a)(s+b)(s+c)}$	$\frac{(\alpha-a)e^{-at}}{(b-a)(c-a)} + \frac{(\alpha-b)e^{-bt}}{(c-b)(a-b)} + \frac{(\alpha-c)e^{-ct}}{(a-c)(b-c)}$
12. $\frac{ab(s+\alpha)}{s(s+a)(s+b)}$	$\alpha - \frac{b(\alpha-a)}{(b-a)}e^{-at} + \frac{a(\alpha-a)}{(b-a)}e^{-bt}$
13. $\frac{\omega}{s^2+\omega^2}$	$\sin \omega t$
14. $\frac{s}{s^2+\omega^2}$	$\cos \omega t$
15. $\frac{s+a}{s^2+\omega^2}$	$\frac{\sqrt{\alpha^2+\omega^2}}{\omega}\sin(\omega t + \phi)$, $\quad \phi = \tan^{-1}\left(\frac{\omega}{\alpha}\right)$
16. $\frac{\omega}{(s+a)^2+\omega^2}$	$e^{-at}\sin \omega t$

Please turn over...

$F(s) = L[f(t)]$	$f(t), \ t \geq 0$
17. $\dfrac{(s+a)}{(s+a)^2+\omega^2}$	$e^{-at}\cos\omega t$
18. $\dfrac{s+\alpha}{(s+a)^2+\omega^2}$	$\dfrac{1}{\omega}\left[(\alpha-a)^2+\omega^2\right]^{\frac{1}{2}}e^{-at}\sin(\omega t+\phi),$ $\phi=\tan^{-1}\left(\dfrac{\omega}{\alpha-a}\right)$
19. $\dfrac{\omega_n^2}{s^2+2\zeta\omega_n s+\omega_n^2}$	$\dfrac{\omega_n}{\sqrt{1-\zeta^2}}e^{-\zeta\omega_n t}\sin\omega_n\sqrt{1-\zeta^2}t, \ \zeta<1$
20. $\dfrac{1}{s\left[(s+a)^2+\omega^2\right]}$	$\dfrac{1}{a^2+\omega^2}+\dfrac{1}{\omega\sqrt{a^2+\omega^2}}e^{-at}\sin(\omega t-\phi),$ $\phi=\tan^{-1}\left(\dfrac{\omega}{-a}\right)$
21. $\dfrac{\omega_n^2}{s\left(s^2+2\zeta\omega_n s+\omega_n^2\right)}$	$1-\dfrac{1}{\sqrt{1-\zeta^2}}e^{-\zeta\omega_n t}\sin\left(\omega_n\sqrt{1-\zeta^2}t+\phi\right),$ $\phi=\cos^{-1}\zeta, \zeta<1$
22. $\dfrac{(s+\alpha)}{s\left[(s+a)^2+\omega^2\right]}$	$\dfrac{\alpha}{a^2+\omega^2}+\dfrac{1}{\omega}\left[\dfrac{(\alpha-a)^2+\omega^2}{a^2+\omega^2}\right]^{\frac{1}{2}}e^{-at}\sin(\omega t+\phi),$ $\phi=\tan^{-1}\left(\dfrac{\omega}{\alpha-a}\right)-\tan^{-1}\left(\dfrac{\omega}{-a}\right)$
23. $\dfrac{1}{(s+c)\left[(s+a)^2+\omega^2\right]}$	$\dfrac{e^{-ct}}{(c-a)^2+\omega^2}+\dfrac{e^{-at}\sin(\omega t+\phi)}{\omega\left[(c-a)^2+\omega^2\right]^{\frac{1}{2}}},$ $\phi=\tan^{-1}\left(\dfrac{\omega}{c-a}\right)$

24. $\dfrac{a}{s^2 - a^2}$	$\sinh at$
25. $\dfrac{s}{s^2 - a^2}$	$\cosh at$
26. $\dfrac{\omega^2}{s(s^2 + \omega^2)}$	$1 - \cos\omega t$
27. $\dfrac{\omega^3}{s^2(s^2 + \omega^2)}$	$\omega t - \sin\omega t$
28. $\dfrac{2\omega^3}{(s^2 + \omega^2)^2}$	$\sin\omega t - \omega t \cos\omega t$

	$F(s) = L[f(t)]$	$f(t),\ t \geq 0$
29.	$\dfrac{s}{(s^2+\omega^2)^2}$	$\dfrac{t}{2\omega}\sin\omega t$
30.	$\dfrac{s^2}{(s^2+\omega^2)^2}$	$\dfrac{1}{2\omega}(\sin\omega t + \omega t\cos\omega t)$
31.	$\dfrac{s}{(s^2+a^2)(s^2+b^2)}\quad (a^2 \neq b^2)$	$\dfrac{1}{b^2-a^2}(\cos at - \cos bt)$

LAPLACE TRANSFORM OF DERIVATIVES

32.	$sF(s) - f(0)$	$f'(t)$, First Derivative
33.	$s^2F(s) - sf(0) - f'(0)$	$f''(t)$, Second Derivative

GENERAL PROPERTIES OF LAPLACE TRANSFORMS

1. Linearity $\quad L[af_1(t) + bf_2(t)] = aF_1(s) + bF_2(s)$

2. Scaling $\quad L[f(at)] = \dfrac{1}{a}F\left(\dfrac{s}{a}\right)$

3. Transform of a Derivative

$$L\left[f^{(n)}(t)\right] = s^nF(s) - s^{n-1}f(0) - s^{n-2}f'(0) - \ldots - sf^{(n-2)}(0) - f^{(n-1)}(0)$$

4. First Shifting Theorem $\quad L\left[e^{at}f(t)\right] = F(s-a)$
   (Complex Translation; s-shifting)

5. Second Shifting Theorem $\quad L[u(t-a)f(t-a)] = e^{-as}F(s)$
   (Real Translation; t—shifting)

6. Integration $\quad L\left[\int_0^t f(\tau)d\tau\right] = \dfrac{1}{s}F(s)$

7. Complex Differentiation $\quad L[tf(t)] = -\dfrac{dF(s)}{ds}$

8. Final Value Theorem $\quad f(\infty) = \lim_{s \to 0} sF(s)$

9. Initial Value Theorem $\quad f(0+) = \lim_{s \to \infty} sF(s)$

Table of Fourier Transform Pairs

Function, f(t)	**Fourier Transform, F(ω)**
Definition of Inverse Fourier Transform $$f(t)=\frac{1}{2\pi}\int_{-\infty}^{\infty}F(\omega)e^{j\omega t}\,d\omega$$	*Definition of Fourier Transform* $$F(\omega)=\int_{-\infty}^{\infty}f(t)e^{-j\omega t}\,dt$$
$f(t-t_0)$	$F(\omega)e^{-j\omega t_0}$
$f(t)e^{j\omega_0 t}$	$F(\omega-\omega_0)$
$f(\alpha t)$	$\frac{1}{\lvert\alpha\rvert}F(\frac{\omega}{\alpha})$
$F(t)$	$2\pi f(-\omega)$
$\frac{d^n f(t)}{dt^n}$	$(j\omega)^n F(\omega)$
$(-jt)^n f(t)$	$\frac{d^n F(\omega)}{d\omega^n}$
$\int_{-\infty}^{t} f(\tau)d\tau$	$\frac{F(\omega)}{j\omega}+\pi F(0)\delta(\omega)$
$\delta(t)$	1
$e^{j\omega_0 t}$	$2\pi\delta(\omega-\omega_0)$
sgn (t)	$\frac{2}{j\omega}$

$j\frac{1}{\pi t}$	$\mathrm{sgn}(\omega)$
$u(t)$	$\pi\delta(\omega)+\frac{1}{j\omega}$
$\sum_{n=-\infty}^{\infty} F_n e^{jn\omega_0 t}$	$2\pi\sum_{n=-\infty}^{\infty} F_n \delta(\omega-n\omega_0)$
$rect(\frac{t}{\tau})$	$\tau Sa(\frac{\omega\tau}{2})$
$\frac{B}{2\pi}Sa(\frac{Bt}{2})$	$rect(\frac{\omega}{B})$
$tri(t)$	$Sa^2(\frac{\omega}{2})$
$A\cos(\frac{\pi t}{2\tau})rect(\frac{t}{2\tau})$	$\frac{A\pi}{\tau}\frac{\cos(\omega\tau)}{(\pi/2\tau)^2-\omega^2}$
$\cos(\omega_0 t)$	$\pi[\delta(\omega-\omega_0)+\delta(\omega+\omega_0)]$
$\sin(\omega_0 t)$	$\frac{\pi}{j}[\delta(\omega-\omega_0)-\delta(\omega+\omega_0)]$
$u(t)\cos(\omega_0 t)$	$\frac{\pi}{2}[\delta(\omega-\omega_0)+\delta(\omega+\omega_0)]+\frac{j\omega}{\omega_0^2-\omega^2}$
$u(t)\sin(\omega_0 t)$	$\frac{\pi}{2j}[\delta(\omega-\omega_0)-\delta(\omega+\omega_0)]+\frac{\omega^2}{\omega_0^2-\omega^2}$
$u(t)e^{-\alpha t}\cos(\omega_0 t)$	$\frac{(\alpha+j\omega)}{\omega_0^2+(\alpha+j\omega)^2}$

$u(t)e^{-\alpha t}\sin(\omega_0 t)$	$\frac{\omega_0}{\omega_0^2+(\alpha+j\omega)^2}$
$e^{-\alpha\|t\|}$	$\frac{2\alpha}{\alpha^2+\omega^2}$
$e^{-t^2/(2\sigma^2)}$	$\sigma\sqrt{2\pi}\,e^{-\sigma^2\omega^2/2}$
$u(t)e^{-\alpha t}$	$\frac{1}{\alpha+j\omega}$
$u(t)te^{-\alpha t}$	$\frac{1}{(\alpha+j\omega)^2}$

- ***Trigonometric Fourier Series***

$$f(t)=a_0+\sum_{n=1}^{\infty}\left(a_n\cos(\omega_0 nt)+b_n\sin(\omega_0 nt)\right)$$

where

$$a_0=\frac{1}{T}\int_0^T f(t)dt \quad , \quad a_n=\frac{2}{T}\int_0^T f(t)\cos(\omega_0 nt)dt \quad \text{, and}$$

$$b_n=\frac{2}{T}\int_0^T f(t)\sin(\omega_0 nt)dt$$

- ***Complex Exponential Fourier Series***

$$f(t)=\sum_{n=-\infty}^{\infty}F_n e^{j\omega nt} \quad \text{, where} \quad F_n=\frac{1}{T}\int_0^T f(t)e^{-j\omega_0 nt}\,dt$$

Some Useful Mathematical Relationships

$\cos(x) = \dfrac{e^{jx} + e^{-jx}}{2}$
$\sin(x) = \dfrac{e^{jx} - e^{-jx}}{2j}$
$\cos(x \pm y) = \cos(x)\cos(y) \mp \sin(x)\sin(y)$
$\sin(x \pm y) = \sin(x)\cos(y) \pm \cos(x)\sin(y)$
$\cos(2x) = \cos^2(x) - \sin^2(x)$
$\sin(2x) = 2\sin(x)\cos(x)$
$2\cos^2(x) = 1 + \cos(2x)$
$2\sin^2(x) = 1 - \cos(2x)$
$\cos^2(x) + \sin^2(x) = 1$
$2\cos(x)\cos(y) = \cos(x - y) + \cos(x + y)$
$2\sin(x)\sin(y) = \cos(x - y) - \cos(x + y)$
$2\sin(x)\cos(y) = \sin(x - y) + \sin(x + y)$

Useful Integrals

$\int \cos(x)dx$	$\sin(x)$
$\int \sin(x)dx$	$-\cos(x)$
$\int x\cos(x)dx$	$\cos(x) + x\sin(x)$
$\int x\sin(x)dx$	$\sin(x) - x\cos(x)$
$\int x^2 \cos(x)dx$	$2x\cos(x) + (x^2 - 2)\sin(x)$
$\int x^2 \sin(x)dx$	$2x\sin(x) - (x^2 - 2)\cos(x)$
$\int e^{ax} dx$	$\frac{e^{ax}}{a}$
$\int xe^{ax} dx$	$e^{ax}\left[\frac{x}{a} - \frac{1}{a^2}\right]$
$\int x^2 e^{ax} dx$	$e^{ax}\left[\frac{x^2}{a} - \frac{2x}{a^2} - \frac{2}{a^3}\right]$
$\int \frac{dx}{\alpha + \beta x}$	$\frac{1}{\beta}\ln\lvert\alpha + \beta x\rvert$
$\int \frac{dx}{\alpha^2 + \beta^2 x^2}$	$\frac{1}{\alpha\beta}\tan^{-1}(\frac{\beta x}{\alpha})$

FAIRCHILD
SEMICONDUCTOR™

August 1986
Revised March 2000

DM74LS153
Dual 1-of-4 Line Data Selectors/Multiplexers

General Description

Each of these data selectors/multiplexers contains inverters and drivers to supply fully complementary, on-chip, binary decoding data selection to the AND-OR-invert gates. Separate strobe inputs are provided for each of the two four-line sections.

Features

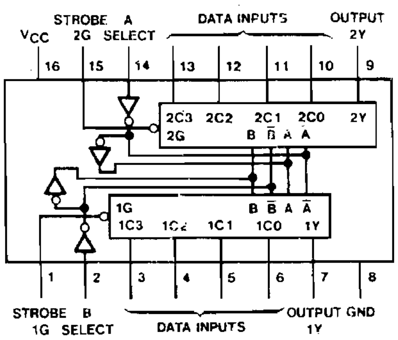
- Permits multiplexing from N lines to 1 line
- Performs at parallel-to-serial conversion
- Strobe (enable) line provided for cascading (N lines to n lines)
- High fan-out, low impedance, totem pole outputs
- Typical average propagation delay times
  From data 14 ns
  From strobe 19 ns
  From select 22 ns
- Typical power dissipation 31 mW

Ordering Code:

Order Number	Package Number	Package Description
DM74LS153M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
DM74LS153N	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Function Table

Select Inputs		Data Inputs				Strobe	Output
B	A	C0	C1	C2	C3	G	Y
X	X	X	X	X	X	H	L
L	L	L	X	X	X	L	L
L	L	H	X	X	X	L	H
L	H	X	L	X	X	L	L
L	H	X	H	X	X	L	H
H	L	X	X	L	X	L	L
H	L	X	X	H	X	L	H
H	H	X	X	X	L	L	L
H	H	X	X	X	H	L	H

Select inputs A and B are common to both sections.
H = HIGH Level
L = LOW Level
X = Don't Care

Logic Diagram