2023-24

B. TECH. (ODD SEMESTER) EXAMINATION

ELECTRONICS ENGINEERING

HIGHER MATHEMATICS-I

AMS-2510

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all questions.
Assume suitable data if missing.
Notations and symbols used have their usual meaning.

Q.No.	Question	CO	M.M.
1(a)	Attempt any **TWO** parts:	(CO1)	[08]
	i. Show that the function $f(z) = \bar{z}$ is continuous at the point $z = 0$ but not differentiable at $z = 0$.		
	ii. Using Cauchy Reimann equation in polar form, find the value of p such that function $f(z) = r^2 \cos 2\theta + ir^2 \sin p\theta$ is analytic.		
	iii. An Integral I over a counter clockwise circle C is given by $I = \oint_C \frac{z^2-1}{z^2+1} e^z dz$. If C is given as $\|z\| = 3$, then show that the value of I is $-4\pi i \sin 1$.		
1(b)	Let $u(x,y) = x^3 + ax^2y + bxy^2 + 2y^3$ be a harmonic function and $v(x,y)$ its harmonic conjugate. If $v(0,0) = 1$, then find the value of $\|a + b + v(1,1)\|$.	(CO1)	[07]
2(a)	Attempt any **TWO** parts:	(CO2)	[08]
	i. Find the radius of convergence and the circle of convergence of the power series $\sum_{n=0}^{\infty} \frac{1}{n!}\left(\frac{iz-1}{2+i}\right)^n$.		
	ii. Evaluate using residue theorem the integral $\int_C \left(\frac{1}{z \sin z} + z^2 e^{1/z}\right) dz$, where $C: \|z\| = 1$.		
	iii. Expand the function $f(z) = \frac{1}{(z+1)(z+3)}$ in Laurent's Series in the regions a) $1 < \|z\| < 3$ b) $0 < \|z-1\| < 2$		
2(b)	Evaluate the integral $\int_{-\infty}^{\infty} \frac{x^2}{(x^2+a^2)(x^2+b^2)} dx, a, b > 0$.	(CO2)	[07]

contd.... 2.

3(a) Attempt any **TWO** parts: (CO3) [08]

i. Find the directional derivative of $\varphi = x^2 - y^2 + 2z^2$ at the point $P(1, 2, 3)$ in the direction of the line PQ, where Q is the point $(5, 0, 4)$.

ii. If $\vec{v}$ represents the linear velocity of a fluid, show that $curl\ \vec{v}$ represents its angular velocity.

iii. Find the constants m and n such that the surface $mx^2 - 2nyz = (m + z)x$ will be orthogonal to $4x^2y + z^3 = 4$ at the point $(1, -1, 2)$.

3(b) A fluid motion is given by $\vec{V} = (x + 2y + az)\hat{\imath} + (bx - 3y - z)\hat{\jmath} + (4x + cy + 2z)\hat{k}$. (CO3) [07]

a) Find the constants $a,\ b,\ c$ so that the motion is irrotational.

b) Show that $\vec{V}$ can be expressed as the gradient of a scalar function.

4(a) Attempt **ALL** parts: (CO4) [09]

i. If $\vec{A} = (3x^2 + 6y)\hat{\imath} - 14yz\hat{\jmath} + 20xz^2\hat{k}$, evaluate $\int_C \overrightarrow{A}.\overrightarrow{dr}$ from $(0,0,0)$ to $(1,1,1)$. Where C is the curve joining the straight lines from $(0,0,0)$ to $(1,0,0)$, then to $(1,1,0)$, and then to $(1, 1, 1)$.

ii. Find the total work done in moving a particle from $(1, -2, 1)$ to $(3, 1, 4)$ in a conservative force field given by $\vec{F} = (2xy + z^3)\hat{\imath} + x^2\hat{\jmath} + 3z^2x\hat{k}$.

iii. Evaluate $\int_C (2xy - x^2)dx + (x + y^2)dy$ using Green's theorem, where C is the closed curve formed by $y = x^2$ and $y^2 = x$.

4(b) Verify stokes theorem in the plane for $\overrightarrow{A} = (2x - y)\hat{\imath} - yz^2\hat{\jmath} - y^2z\hat{k}$, where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ and C is its boundary. (CO4) [06]

OR

4(b') Find the flux of the vector field

$$\vec{A} = (x - 2z)\hat{\imath} + (x + 3y + z)\hat{\jmath} + (5x + y)\hat{k}$$

through the upper side of the triangle ABC with vertices at the point $A(1,0,0), B(0,1,0), C(0,0,1)$.

2023-24

B. TECH. (ODD SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
HIGHER MATHEMATICS-II
AMS-2520

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all questions.
Notations and symbols used have their usual meaning.
Marks allotted to each question and course outcome (CO) covered are indicated against each question.

Q.No.	Question	CO	M.M.
1(a)	Write the condition of convergence for general iteration method. Find a real root of the equation $\cos x - 3x + 1 = 0$ correct to 3 decimal places by using general iteration method.	(CO1)	[07]
	OR		
1(a')	Define the rate of convergence of an iteration method. Show that Newton Raphson method has a quadratic convergence. Find the cube root of 20 correct to two decimal places by using Newton Raphson method.	(CO1)	[07]
1(b)	State diagonal dominance condition and hence perform three iterations of the Gauss-Seidel iteration method for solving the system of linear equations: $$3x - 0.1y - 0.2z = 7.85$$ $$0.3x - 0.2y + 10z = 71.4$$ $$0.1x + 7y - 0.3z = -19.3.$$	(CO1)	[08]
2(a)	From the following table, estimate the number of students who obtained marks between 40 and 45. Also find the number of students getting marks less than 75:	(CO2)	[07]

Marks	30-40	40-50	50-60	60-70	70-80
Number of students	31	42	51	35	31

2(b)	By using Newton's divided difference formula, find the values of $f(3)$ and $f(8)$ from the table given bellow:	(CO2)	[08]

x	4	5	7	10	11	13
$f(x)$	48	100	294	900	1210	2028

Contd....2.

OR

2(b') (i) The population of a certain town is shown in the following table: (CO2) [08]

Year	1931	1941	1951	1961	1971
Population in thousands	40.62	60.80	79.95	103.56	132.65

Find the rate of growth of the population in 1961.

(ii) The velocity v of a particle at a distance x from a point on its path is given

x	0	10	20	30	40
v	45	60	65	54	42

Use Simpson's rule to find the time taken to traverse the distance 40 units.

3(a) Solve $y' = 2 + \sqrt{xy}$ with $y(1.2) = 1.6403$ by Euler's modified method for (CO3) [07]
$x = 1.6$, correct up to four decimal places by taking $h = 0.2$.

3(b) Solve the boundary value problem (CO3) [08]

$$y'' + 3y' - 2y = 2x + 3,$$

with $y(0) = 2,\ y(1) = 1$

by the finite-difference method. Use $h = 0.25$.

4(a) If mean and variance of a binomial distribution are 4.5 and 1.125 respectively. Find (CO4) [07]
$P(X \geq 1), P(1 < X < 5)$ and $P(X \geq 3)$.

4(b) A random variable X has the following probability function: (CO4) [08]

X	0	1	2	3	4	5	6	7
$P(X = x)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2 + k$

(i) Determine k. (ii) Evaluate $P(X < 6),\ P(X \geq 6),\ P(0 < X < 5)$.

(iii) Find the mean and variance.

OR

4(b') A random variable X gives measurements x between 0 and 1 with a probability (CO4) [08]
function

$$f(x) = \begin{cases} 12x^3 - 21x^2 + 10x, & 0 \leq x \leq 1 \\ 0, & \text{otherwise} \end{cases}$$

(i) Find $P(X < 1/2),\ P(1/6 \leq X \leq 1/4),\ P(X > 1/2)$. (ii) Find a number k such that $P(X \leq k) = 1/2$. (iii) Find the mean and variance.

2023-24
B. TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
Electronic Devices & Circuits
ELC-2110

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all questions.
Assume suitable data if missing. $\mathcal{E}_o = 8.85\times10^{-12}$ F/m; $\mathcal{E}_{si} = 11.7\ \mathcal{E}_o$; $\mu_n C_{ox} = 100\ \mu A/V^2$, $\mu_p C_{ox} = 50\ \mu A/V^2$; $n_i = 1.5\times10^{10}$ cm^{-3}
Notations and symbols used have their usual meaning.

Q.No.	Question	CO	M.M.
1(a)	Derive the capacitance of pn junction under a reverse bias of V_R.	(CO1)	[06]
	OR		
1(a′)	Derive the diode equation for current under forward bias.	(CO1)	[06]
1(b)	(i) A *pn* junction is doped with $N_A = 2\times10^{16}$ cm^{-3} and $N_D = 9\times10^{15}$ cm^{-3}. Determine the capacitance of the device with (a) $V_R = 0$ and $V_R = 1$ V. (ii) A cellphone incorporates a 2-GHz oscillator whose frequency is defined by the resonance frequency ($1/2\pi\sqrt{LC}$) of an *LC* tank (Fig. 1). If the tank capacitance is realized as the *pn* junction of (i), calculate the change in the oscillation frequency while the reverse voltage goes from 0 to 2 V. Assume the circuit operates at 2 GHz at a reverse voltage of 0 V, and the junction area is 2000 μm^2.	(CO1)	[09]

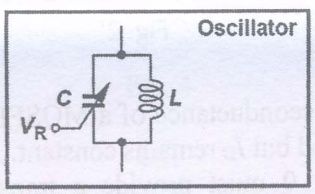


Fig. 1 Variable capacitor used to tune an oscillator.

2(a)	Most applications require that the transconductance of a transistor remain relatively constant as the signal level varies. Since the signal changes, the collector current varies. If a bipolar device is biased at $I_C = 1$ mA, what is the largest change in V_{BE} that guarantees only ±10% variation in g_m?	(CO2)	[06]
2(b)	Derive the voltage gain of a Common Source amplifier with Emitter degeneration. Hence, determine the voltage gain of the stage shown in Fig. 2	(CO2)	[09]

contd....2.

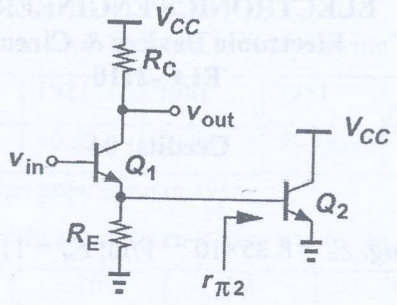


Fig. 2

OR

2(b′) In an audio application shown in Fig. 2′, the collector bias voltage is 1.5 V. If $I_S = 5 \times 10^{-17}$ A and $V_A = \infty$, compute the β of the transistor. If the speaker has a resistance of 4Ω, calculate the gain in signal amplitude. Explain why the circuit provides no gain. (CO2) [09]

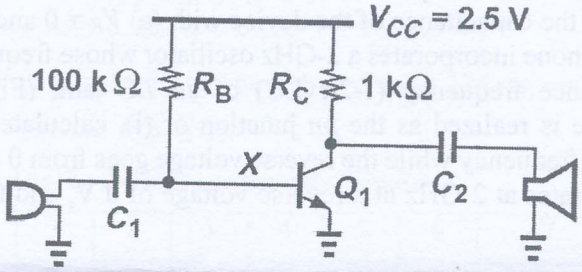


Fig. 2′

3(a) Determine how the transconductance of a MOSFET (operating in saturation) changes if W/L is doubled but I_D remains constant. An NMOS device operating in saturation with $\lambda = 0$ must provide a transconductance of 1/(50 Ω). Determine W/L if $I_D = 0.5$ mA. (CO3) [06]

3(b) (i) Identify the circuit shown in Fig. 3 and derive the voltage gain. (CO3) [09]

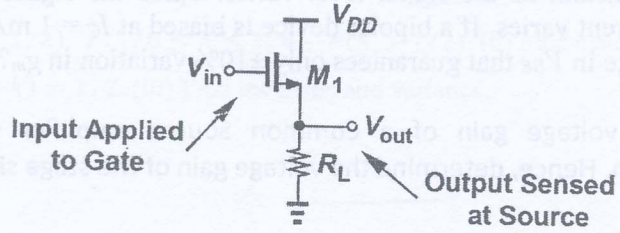


Fig. 3

(ii) A source follower is realized as shown in Fig. 3′, where M_2 serves as a current source. Calculate the voltage gain of the circuit.

Contd.....3.

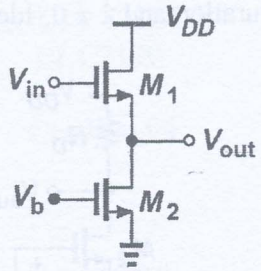


Fig. 3′

4(a) An integrated circuit requires two current sources: $I_1 = 1$ mA and $I_2 = 1.5$ mA. Assuming that only integer multiples of a unit bipolar transistor having $I_S = 3 \times 10^{-16}$A can be placed in parallel, and only a single voltage source, V_B, is available (Fig. 4), construct the required circuit with minimum number of unit transistors. (CO4) [06]

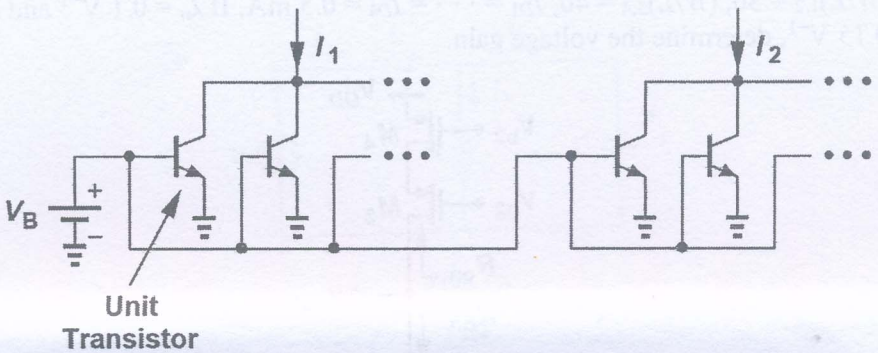


Fig. 4

OR

4(a′) An integrated circuit employs the source follower and the common-source stage shown in Fig. 4′. Design a current mirror that produces I_1 and I_2 from a 0.3 mA reference. (CO4) [06]

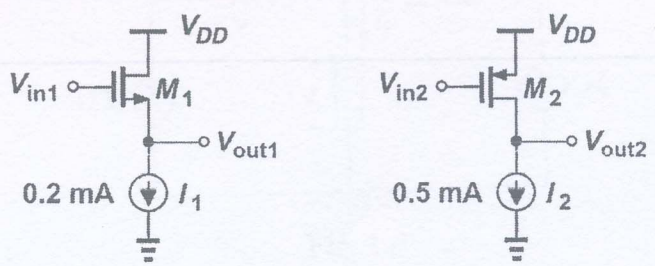


Fig. 4′

contd....4.

4(b) Construct the small-signal model of the circuit depicted in Fig. 5. Assume all transistors operate in saturation and $\lambda \neq 0$. Identify the circuit and derive the voltage gain. (CO4) [09]

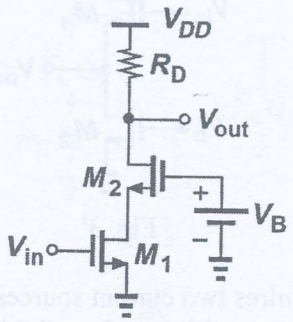


Fig. 5

OR

4(b′) The cascode amplifier of Fig. 5′ incorporates the following device parameters: $(W/L)_{1,2} = 30$, $(W/L)_{3,4} = 40$, $I_{D1} = \cdots = I_{D4} = 0.5$ mA. If $\lambda_n = 0.1\ V^{-1}$ and $\lambda_p = 0.15\ V^{-1}$, determine the voltage gain. (CO4) [09]

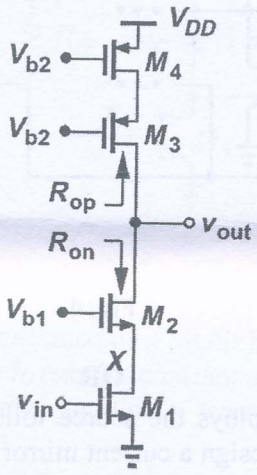


Fig. 5′

2023-24

B. TECH. (ODD SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
CIRCUIT THEORY
ELC2120

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all questions.
Assume suitable data if missing.
Notations and symbols used have their usual meaning.

Q.No.	Question	CO	M.M.
1(a)	In the circuit shown in Fig. 1a, take the current through the inductor (i) and the voltage across the capacitor (v) as state variables, v_s as the input and i_x as the output. Find the state-space representation of the circuit shown in Fig. 1a? Determine the transfer function of the circuit when R=1 Ω, C=0.25F, and L = 0.5H.	(CO1)	[8]

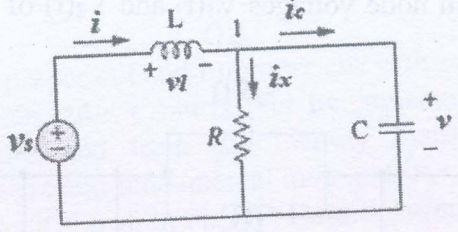


Fig. 1a

OR

1(a')	Define Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL) with suitable diagrams and mathematical equations. Calculate v and i_x in the circuit shown in Fig. 1a' using KCL and KVL?	(CO1)	[8

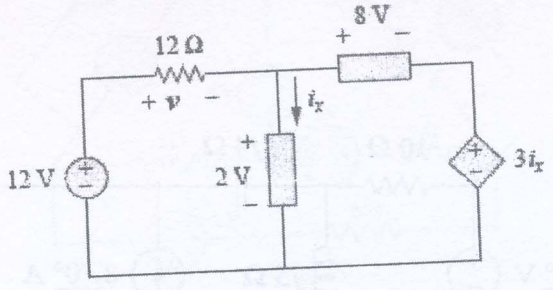


Fig. 1a'

Contd.... 2.

1(b) Find v(t) for t < 0 and t > 0 in the circuit of Fig. 1b. v(t) is the voltage across 2 Ω resistor. Mention the steps with reasons. (CO1) [7]

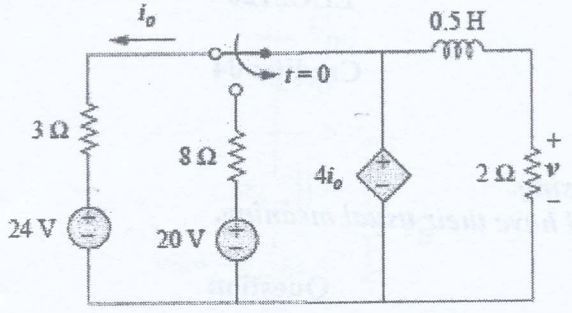


Fig. 1b

2(a) Define reciprocity theorem with suitable diagram. Write three conditions in which this theorem can be applied? (CO2) [5]

2(b) Find the time-domain node voltages $V_1(t)$ and $V_2(t)$ of the circuit shown in Fig. 2b? (CO2) [5]

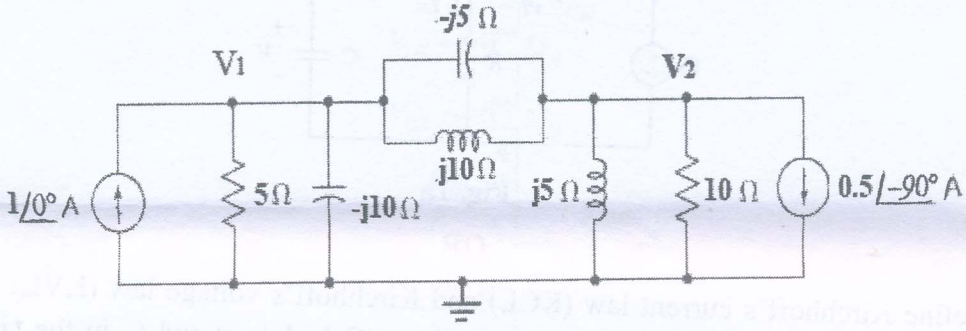


Fig. 2b

2(c) Find the Thevenin's equivalent of the circuit shown in Fig. 2c across the terminals a-b. (CO2) [5]

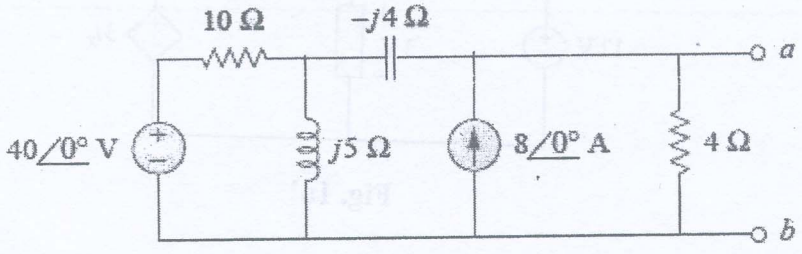


Fig. 2c

Contd... 3.

3(a) Consider the oriented graph shown in Fig. 3a. Make a tree consisting of the branches 1, 2, and 3. Find the fundamental loop matrix and fundamental cut-set matrix for the above tree. Briefly write the steps for calculating both the matrices. (CO3) [4+4]

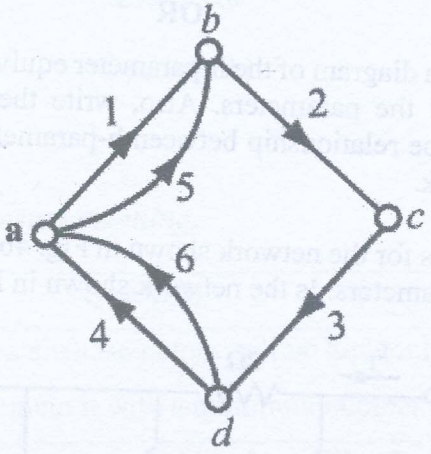


Fig. 3a

OR

3(a') Explain the concept of proper cut and improper cut with suitable diagrams. What is the difference between cut-set matrix and fundamental cut-set matrix. What information can be obtained from the Identity matrix obtained from the fundamental cut-set matrix and fundamental loop matrix. (CO3) [3+3 +2]

3(b) Draw a graph of the circuit shown in Fig. 3b. Does the graph depend on the values of the circuit elements? What is the general relationship between the number of branches of a graph and number of branches of a tree? (CO3) [4+1 +2]

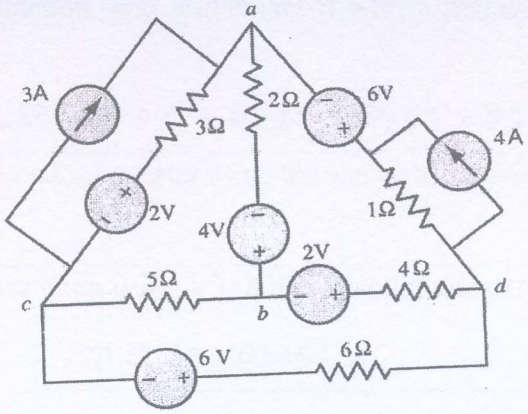


Fig. 3b

contd ... 4.

4(a) Draw a neat and clean diagram with proper labelling to show parallel connection of 2, two port networks. Derive the equivalent parameter matrix for the same? (CO4) [4+4]

OR

4(a') Draw a neat and clean diagram of the h-parameter equivalent network of a two port network showing all the parameters. Also, write the names of all the four h-parameters. Derive the relationship between h-parameters and ABCD parameters of a two-port network. (CO4) [4+4]

4(b) Find the y-parameters for the network shown in Fig. 4b? Write the steps briefly for calculating the y-parameters. Is the network shown in Fig. 4b reciprocal? (CO4) [7]

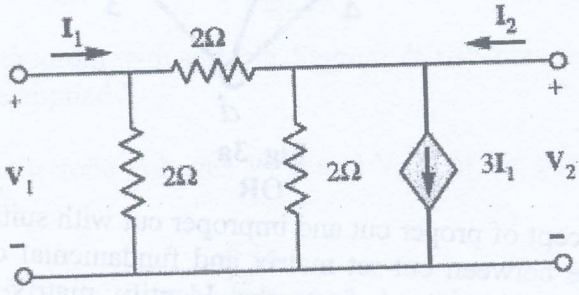


Fig. 4b

2023-24
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
ELECTRONIC CIRCUITS
ELC-2140

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

In the following problems, unless otherwise stated, assume $\mu_n C_{ox}$ = 200 μA/V², $\mu_p C_{ox}$ = 100 μA/V², V_{DD} = 1.8 V and V_{TH} = 0.4 V for NMOS devices and −0.4 V for PMOS devices.

Q. No.	Question	CO	M. M.
1(a)	An integrated circuit employs the source follower shown in Fig. 1. Design a current mirror that produces I_1 from a 0.4 mA reference.	CO1	[06]

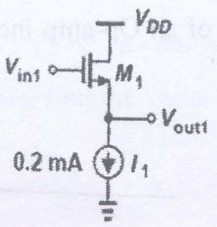


Fig. 1

1(b)	Explain the operation of Bipolar Current Mirror.	CO1	[09]
2	Using suitable circuit diagrams, explain the operation of a differential amplifier.	CO2	[15]

OR

2'(a)	Explain how a differential amplifier removes noise from the input signal using the concept of common mode gain. What is CMRR?	CO2	[06]
2'(b)	Perform large signal analysis for MOS differential amplifier with passive load, and derive the drain currents and differential output voltage as functions of differential input voltage. Plot the characteristics thus obtained. How are these characteristics affected if I_{SS} and W/L are halved?	CO2	[09]
3(a)	Fig. 2 depicts a transistor-level realization of a feedback circuit. Assume λ = 0 and $R_1 + R_2 \gg R_D$ for simplicity. Identify the four components of the feedback system, and determine the closed-loop voltage gain.	CO3	[06]

contd...2.

6578

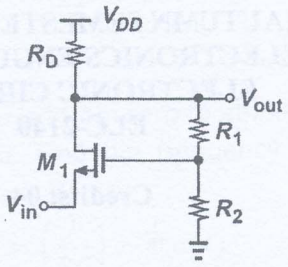


Fig. 2

3(b)	What are the different types of feedback topologies? Derive the effect of negative feedback on input impedance in each case.	CO3	[09]

OR

3'(a)	What are the effects of negative feedback?	CO3	[09]
3'(b)	Give an application of positive feedback. What is Barkhausen's criteria?.	CO3	[06]
4	Explain the operation of Emitter Follower and Push-pull amplifier as output stages and compare their performance.	CO4	[15]

OR

4'	Describe the various stages of an Op-amp including the roles performed by each.	CO4	[15]

2023-24

B. TECH. (ODD SEMESTER) EXAMINATION

ELECTRONICS ENGINEERING

LOGIC CIRCUITS

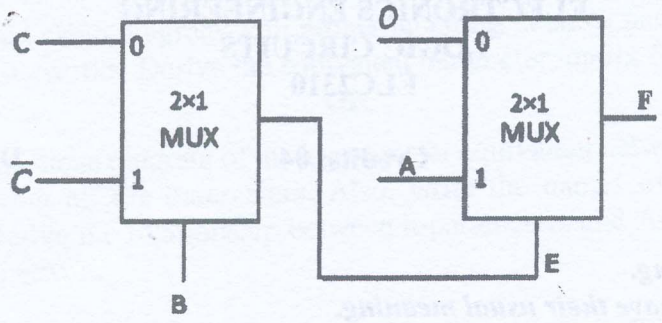
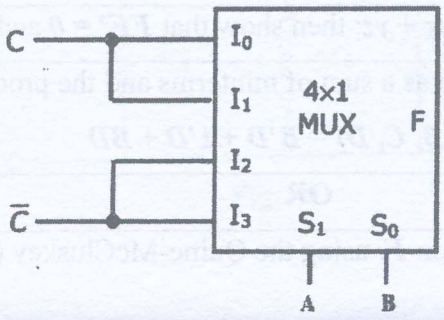
ELC2310

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all questions.
Assume suitable data if missing.
Notations and symbols used have their usual meaning.

Q.No.	Question	CO	M.M.
1(a)	Design a logic circuit of 3 inputs whose output will be high only when a majority of inputs are high. Also, implement it with a minimum number of NOR gates.	(CO1)	[07]
1(b)	Find the complement of $F = wx + yz$; then show that $FF' = 0$ and $F + F' = 1$.	(CO1)	[03]
1(c)	Express the following function as a sum of minterms and the product of maxterms. $F(A, B, C, D) = B'D + A'D + BD$	(CO1)	[05]
	OR		
1'(a)	Minimise the following function F, using the Quine-McCluskey (QM) Technique (Tabular Method). $F(A, B, C, D) = \sum (0,1,3,7,8,9,11,15)$	(CO1)	[09]
1'(b)	Simplify the following function, and implement it with a minimum number of NAND gates. $F(A, B, C, D) = (A' + C' + D')(A' + C')(C' + D')$	(CO1)	[06]
2(a)	Design a BCD to Excess-3 code converter using the Variable Entered Maps (VEM) method.	(CO2)	[07]
2(b)	Implement the following function using a 3×8 line decoder and external OR gate. $F(A,B,C)=A'B+AC'$	(CO2)	[05]

contd....2.

2(c)	Determine the Boolean function *F* implemented using the figure shown below. 	(CO2)	[03]
	OR		
2(c')	What logic Expression is realized by the circuit shown below? 	(CO2)	[03]
3(a)	Design and implement a Synchronous Counter using T flip-flops with counting sequence 0, 1, 3, 7, 6, 4. Assume that if an unused state is encountered the state machine jumps to 000.	(CO3)	[07]
	OR		
3(a')	Discuss the operation of the clocked D flip-flop with the help of gate level logic diagram. Also, determine its characteristic table, characteristic equation and excitation table.	(CO3)	[07]
3(b)	A digital system has a clock generator that produces pulses at a frequency of 80 MHz. Design a circuit that provides a clock with a cycle time of 50 ns.	(CO3)	[03]
3(c)	Design and implement a JK flip-flop using an SR flip-flop with the help of their characteristic tables, characteristic equations and excitation tables.	(CO3)	[05]

Contd.... 3.

4(a)	Implement a 2-bit by 2-bit Binary Multiplier using AND gates and half adders only. Also, implement a 4-bit by 3-bit Binary Multiplier with the help of AND gates and two 74HC283 adder ICs.	(CO4)	[07]
4(b)	Implement a full adder circuit using NAND gates only.	(CO4)	[04]
4(c)	(i) Subtract $2A4_{16}$ from $67F_{16}$. (ii) Subtract 164_8 from 723_8.	(CO4)	[04]

Paper Code: 6580

2023-24

B.TECH. END SEMESTER (ODD SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
SIGNALS AND SYSTEMS (ELC2410)

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Assume suitable data if missing.
Notations and symbols used have their usual meaning.

			M.M.
1 a	Consider the signal $x(t)$ defined by $$x(t)=\begin{cases} t+4, & -4\le t\le -2 \\ 2, & -2\le t\le 0 \\ 0, & \text{otherwise} \end{cases}$$ Sketch the following signals: i. $x(t)$, $x_e(t)$: even part of $x(t)$ and $x_o(t)$: odd part of $x(t)$. ii. $y(t)=x_o(4t)$ and $z(t)=y(t/4)$.	CO1	6+3
1 b	Find the zero input response of an LTI system described by the following differential equation $$\frac{d^2y(t)}{dt^2}+3\frac{dy(t)}{dt}+2y(t)=\frac{dx(t)}{dt}$$ Assume the initial conditions are $y_0(0)=0, \dot{y}_0(0)=-5$	CO3	6
	OR		
1' a	Write the signal $f(t)$ shown in Figure 1a in terms of $r(t)$ shown in Figure 1b.	CO1	4

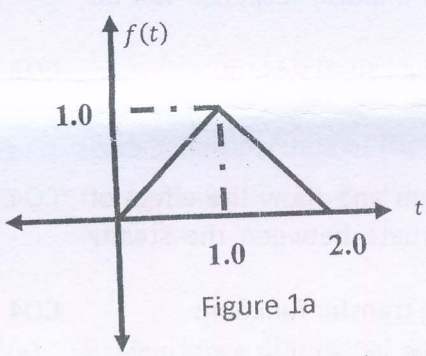


Figure 1a

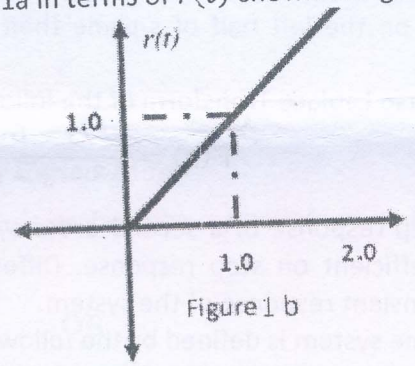


Figure 1 b

1' b	Show that the following moving average system is BIBO stable. $$y[n]=\frac{1}{3}[x[n]+x[n-1]+x[n-2]]$$	CO1	5
1' c	Find the response $y[n]$ of a system with sample impulse response $h[n]$ and excitation $x[n]$. Assume the impulse response $h[n]$ and the excitation $x[n]$ is given by: $$x[n]=\begin{cases} 2, & n=0 \\ 3, & n=1 \\ -2, & n=2 \\ 0, & otherwise \end{cases} \quad h[n]=\begin{cases} 1, & n=\pm 1 \\ 2, & n=0 \\ 0, & otherwise \end{cases}$$	CO3	6
2 a	A sinusoidal signal of frequency f_c and amplitude A is truncated to duration $\pm\frac{T}{2}$. Calculate its Fourier Transform and plot its spectrum. Also discuss the	CO2	6+3

Contd....2.

effect on the spectrum if T is varied from zero to infinity.

2 b Define a unit impulse function. Find the frequency response of the RC circuit given the impulse response as: CO3 1+5

$$h(t) = \left(\frac{1}{RC}\right) e^{-\frac{t}{RC}} u(t)$$

OR

2' a An excitation function $x(t)$ is applied to a system with response $y(t)$ as shown in the Figure 2. Find the Fourier transform of the response given that $x(t) = e^{-3t}u(t)$ and $v(t) = e^{-2t}u(t-2)$ CO3 6

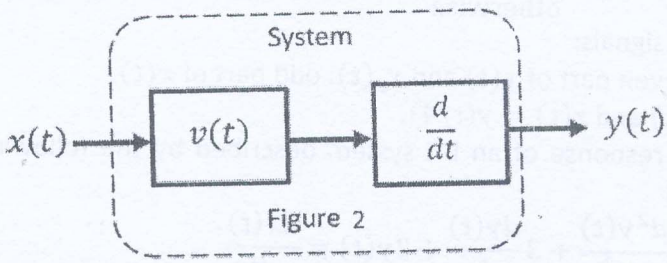


Figure 2

2' b For a signal $x(t) = e^{-at}u(t)$, prove the Parseval's Theorem. Find the bandwidth of the signal so that the energy is 95% of the total signal energy. CO2 5+4

3 a Show that for a first order stable causal system if the pole of the transfer function lies on the left half of s-plane then its impulse response will be right sided. CO3 5

3 b Find the inverse Laplace Transform of the following causal system: CO3 6

$$F(s) = \frac{7s - 6}{(s^2 - s - 6)}$$

3 c Draw the step response of a second order system and show the effect of damping coefficient on step response. Differentiate between the steady state and transient response of the system. CO4 4

4 a A discrete time system is defined by the following transfer function: CO4 9

$$H(z) = \frac{(1 - z^{-1} + z^{-2})}{(1 - 2z^{-1})\left(1 - \frac{1}{2}z^{-1}\right)(1 - z^{-1})} \quad \text{RoC} \quad 1 < |z| < 2$$

Plot the location of the poles and mark the region of convergence of the systems. Also calculate the impulse response of the above systems.

4 b State the sampling theorem for a low pass signal. Differentiate between natural and flat top sampling. CO4 6