(Please write your Exam Roll No.) Exam Roll No. 03117716023

END TERM EXAMINATION

VLSI/ECE

THIRD SEMESTER [B.TECH] DECEMBER-2024

Paper Code: ES-201 **Subject: Computational Methods**

Time: 3 Hours **Maximum Marks: 60**

Note: Attempt five questions in all including Q. no.1 which is compulsory. Select one question from each unit. Scientific calculator is allowed.

Q1 (a) Determine the decimal number that correspond to the machine word $[45DE4000]_{16}$ **(2)**

(b) Using secant method find the root of $x\sin(x) - 3\cos(x) = 0$ between (0.0, 1.8) with accuracy of 2 digits after decimal point. **(3)**

(c) For following given set of data for x & y, formulate the Newton divided differences table. **(3)**

x	0.00	2.00	4.00	6.0	8.0
y	0.00	8.00	64.00	216.00	512.00

(d) Compute $\int_0^1 \frac{\sin(x)}{x} dx$ by using the composite Trapezoid rule with six uniform points. Assign the value $\left(\frac{\sin x}{x}\right) = 1$ *at* $x = 0$. **(3)**

(e) Define Decomposition of any matrix. Explain the required condition for Doolittle and Crout decomposition method. **(2)**

(f) Find the value of λ for which the system of equations $x+y+4z=1$, $x+2y-2z=1$ & $\lambda x+y+z=1$, will have unique solution. **(3)**

(g) Using Euler's method find the value of y at x=0.10 of the ODE $\frac{dy}{dx} = x + y + xy$ Where initial conditions are $x_0 = 0.00$ & $y_0 = 1.00$ and using step size 0.10. **(3)**

(h) Give an example and conditions of Parabolic, Hyperbolic and Elliptic partial differential equations. **(1)**

UNIT – I

Q2 (a) Find the value of function $f(x) = 1 - \cos(x)$ *at* $x = 0.1$. Modify the expression so that loss of significant digits can be avoided and calculate the value again. Compare two values with the true value 0.4996 x 10^{-2}. **(5)**

(b) Define rate of convergence and stability of iterative method. Prove that the rate of convergence of Newton-Raphson method is 2. **(5)**

Q3 (a) Define Multivariate unconstraint minimization problem with an example. Using Newton Method to minimize multivariate function, minimize $f(x^k) = 4x_1^2 + x_2^2 - 2x_1x_2$ *starting at* $x_0^k = [1,1]^T$, *where* $x^k = [x_1, x_2]^T$ **(5)**

(b) Determine the minimum point of the function $f(x) = x^2 - 7x + 12$ by Fibonacci search method, if the first uncertainty interval is [2,4] . **(5)**

P.T.O.

P-1/3

UNIT-II

Q4 (a) Explain error estimation in Newton-Gregory Forward interpolation. Also prove that the maximum error in Newton's Forward interpolation is 1 when $|x-x_0| < h$, where h is step size of the given data. **(5)**

(b) For the given set of data for X and Y construct the table of forward differences. Find the interpolated value of Y at X=4.60 using Newton forward interpolation formula. Also find the estimated error in interpolated value. **(5)**

X	1.0	2.0	3.0	4.0	5.0	6.0
Y	7.0	13.0	21.0	32.0	48.0	70.0

Q5 (a) Find $I = \int_0^1 x dx$, by Gaussian Quadrature formula for n=4. Where the values of 'abscissae and Weights' corresponding to n=4 are given.
Abscissae = $(\pm 0.33998 \& \pm 0.86114)$ *and corresponding Weights* = (0.65214 & 0.34785) **(4)**

(b) Evaluate the definite integral $\int_0^1 \frac{1}{1+x} dx$ correct to three decimal point using the basic trapezoidal rule with $h = 0.5, 0.25$ *and* 0.125 *then* obtain a better estimate using Romberg's method. Compare the results with the true value. **(6)**

UNIT-III

Q6 (a) Test the consistency of the system of following given equations:

$$\begin{cases} 5x_1 + 3x_2 + 7x_3 = 4 \\ 3x_1 + 26x_2 - 2x_3 = 9 \\ 7x_1 + 2x_2 + 10x_3 = 3 \end{cases}$$

If the system is consistent, is the system have finite solution or infinite solution? **(4)**

(b) Explain the concept of partial pivoting and hence solve the following given system of linear equation by Guass-Jordan method. The system of linear equations is: **(6)**

$$\begin{aligned} x_1 + x_2 + x_3 &= 1 \\ 4x_1 + 3x_2 - x_3 &= 6 \\ 3x_1 + 5x_2 + 3x_3 &= 4 \end{aligned}$$

Q7 (a) Obtain the linear Spline for the function f(x) define by the data given below

x	1	2	4	8
f(x)	3	7	21	73

Evaluate the function at x=3. **(4)**

(b) Solve the following given system of linear equations using Cholesky factorization method: **(6)**

$$\begin{aligned} 25x + 15y - 5z &= 35 \\ 15x + 18y &= 33 \\ -5x + 11z &= 6 \end{aligned}$$

P.T.O.

UNIT-IV

Q8 (a) Using Picard method, compute y(0.2) to three decimal precision from $\frac{dy}{dx} = x + y$ *given that* $y(0) = 1$. Compare the result with the exact result for the value of y at 0.2. **(4)**

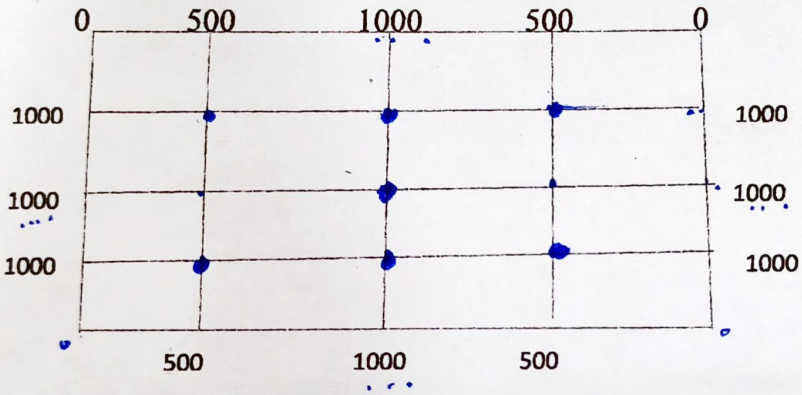
(b) Consider the initial value problem $\begin{cases} \frac{dx}{dt} = t + x^2 \\ x(0) = 1 \end{cases}$

Using Runge-Kutta method of 4th order find x(0.2) taking h=0.1. **(6)**

Q9 (a) Solve the initial value problem

$\frac{dy}{dx} = x - y^2$ *in the range* $0 \le x \le 1$, *for the initial condition* $y(0) = 0$. **(4)**

(b) Solve the elliptical equation $u_{xx} + u_{yy} = 0$ for the following square mesh with oundary values given as **(6)**



****

P-3/3
ES-201

(Please write your Exam Roll No.) VLSI Exam Roll No. .....

023177

END TERM EXAMINATION

THIRD SEMESTER [B.TECH] DECEMBER 2024

Paper Code: ECC-205 **Subject: Signals and Systems**

Time: 3 Hours **Maximum Marks: 60**

Note: Attempt five questions in all including Q.No.1 which is compulsory. Select one question from each unit. Assume missing data, if any.

Q1 Attempt **all** questions:

a) Check whether the signal $x(t) = 2\cos(50\pi t) + \sin(10\pi t)$ is periodic or aperiodic. If periodic, determine the fundamental period. **(4)**

b) A discrete time signal is described by x[n]=[1, 2, 3, 2, 1]. Determine x[n/2]. **(4)**

c) Find Discrete Time Fourier Transform of signal $x[n]=2^n u[n]$. **(4)**

d) State and prove final value theorem of Z-Transform. **(4)**

e) Write the Dirichlet conditions for existence of Fourier Transform. **(4)**

UNIT-I

Q2 a) A continuous time signal is expressed by $x(t) = 1 + \sin\omega_0 t + 2\cos\omega_0 t + \cos(2\omega_0 t + \frac{\pi}{4})$, where ω_0 is the fundamental frequency of the signal. Determine the Fourier series coefficients of x(t). Also, sketch their magnitude plot. **(7)**

b) State and explain sampling theorem **(3)**

OR

Q3 Let $x(t)=u(t-3)-u(t-5)$ and $h(t)=e^{-3t}u(t)$. Compute **(10)**

a) $y(t) = x(t)*h(t)$

b) $g(t) = [dx(t)/dt]*h(t)$

c) How is g(t) related to y(t)?

UNIT-II

Q4 a) Consider a causal LTI system with frequency response $H(j\omega) = \frac{1}{3+j\omega}$. For a particular input x(t) this system is observed to produce the output $y(t) = e^{-3t}u(t) - e^{-4t}u(t)$. Determine x(t). **(7)**

b) Find the Fourier Transform of signal of Signal $x(t) = \frac{1}{1+t^2}$. However, the Fourier Transform of $g(t) = e^{-|t|}$ is given as: $G(\omega) = \frac{2}{1+\omega^2}$. **(3)**

OR

Q5 a) Determine whether the signal y(t)=x(t)+x(t-2) is (a) Linear or nonlinear, (b) Static or dynamic, (c) Causal or non-causal and (d) Time variant or time invariant. **(7)**

P.T.O.

P-1/2
ECC-205

b) Consider an LTI system with the differential equation $\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 3y(t) = \frac{dx(t)}{dt} + 2x(t)$. Find the frequency response & impulse response. **(3)**

UNIT-III

Q6 a) Compute the Discrete Time Fourier Transform of the following functions. **(7)**

i. x[n] = u[n-2]-u[n-6]

ii. $x[n] = (1/2)^{-n}u[-n-1]$

b) Find Inverse Discrete Time Fourier Transform of a signal **(3)**

$$X(e^{j\omega}) = \frac{e^{-j\omega} - \frac{1}{5}}{1 - \frac{1}{5}e^{-j\omega}}$$

OR

Q7 a) Find the circular convolution of the following sequences: **(7)**

$x_1[n] = \{1, -1, 2, 3\}$; $x_2[n] = \{0, 1, 2, 3\}$

b) Compute 4-point DFT of x[n]={1, 2, 1, 2} **(3)**

UNIT-IV

Q8 a) Determine the Z-Transform and ROC of the signal **(7)**

$$x[n] = 7(\frac{1}{3})^n u[n] - 6(\frac{1}{2})^n u[n]$$

b) Write the properties of Region of Convergence. **(3)**

OR

Q9 Consider a signal y[n] which is related to two signals $x_1[n]$ and $x_2[n]$ by **(10)**

$$y[n] = x_1[n+3] * x_2[-n+1]$$

Where $x_1[n] = (\frac{1}{2})^n u[n]$ and $x_2[n] = (\frac{1}{3})^n u[n]$

Given that

$$a^n u[n] \overset{z}{\leftrightarrow} \frac{1}{1 - az^{-1}}, |z| > |a|$$

Use the properties of Z-Transform to determine the Z-Transform Y(z) of y[n].

****

VLSI / CSE

(Please write your Exam Roll No.) Exam Roll No. 09917702723

END TERM EXAMINATION

THIRD SEMESTER [B.TECH] DECEMBER-2024

Paper Code: ECC-207 **Subject: Digital Logic & Computer Design**

Time: 3 Hours **Maximum Marks: 60**

Note: Attempt five questions in all including Q. no.1 which is compulsory. Select one question from each unit.

Q1 Attempt all Questions

(a) Convert $(1111000100)_2$ to gray, XS-3 and BCD. **(4)**

(b) Implement half adder using NAND gate only. **(4)**

(c) What is race around condition in flip-flops? How can it is overcome? **(4)**

(d) Differentiate between Ring and Johnson counter. **(3)**

(e) What is an Input-Output processor (IOP), and how does it contribute to the efficiency of I/O operations? **(3)**

(f) Differentiate between RISC and CISC. **(2)**

UNIT-I

Q2 (a) Simplify the following boolean function using Quine-McCluskey Method. **(6)**

f{A,B,C,D} = □m (1, 2, 4, 5, 7, 8, 10, 11, 12, 14).

(b) Find a minimal SOP using K-Map and draw the circuit of minimal expression. **(4)**

f{A,B,C,D} = □m (1, 3, 4, 5, 9, 10, 11) + d (6,8).

Q3 (a) Design a 4-bit magnitude comparator circuit. Provide the truth table for the comparator. **(5)**

(b) Design a 16-to-1 multiplexer using 8-to-1 multiplexers. Provide the logic diagram and truth table for your design. **(5)**

UNIT-II

Q4 (a) Explain the concept of a modulus counter. Design a synchronous counter with a modulus of 9 using JK flip-flops. **(5)**

(b) How does a serial-in-parallel-out (SIPO) shift register differ from a parallel-in-serial-out (PISO) shift register? Consider a 4-bit serial-in, serial-out (SISO) shift register with an initial state of 1101. Assume a clock signal that triggers the shift operation on each rising edge. The input data is 1010. Illustrate the state transitions of the shift register for each clock cycle, showing the output after each shift operation. After four clock cycles, what will be the final state of the shift register? **(5)**

P.T.O.

P-1/2

Q5 (a) Design a sequence detector which detects 1100 (non overlapping) from any given sequence. Implement using D flip flop. **(5)**

(b) Describe the architecture of a Programmable Array Logic (PAL) device. How does it differ from a PLA in terms of structure and functionality? **(5)**

UNIT-III

Q6 (a) Explain the role of the control unit, ALU, and registers in the CPU. How do they work together to execute instructions? **(5)**

(b) Describe arithmetic micro-operations in the context of computer organization. Provide examples of arithmetic operations and how they are performed at the micro-operation level. **(5)**

Q7 (a) Define assembly language and describe its relationship with machine language. **(5)**

(b) Explain the concept of microprogrammed control in computer architecture. How does it differ from hardwired control, and what are its advantages? **(5)**

UNIT-IV

Q8 (a) Discuss the principles of cache mapping, including direct-mapped, set-associative, and fully associative cache mapping. **(5)**

(b) Describe the role of direct memory access (DMA) in input-output operations. **(5)**

Q9 (a) Define virtual memory. How does virtual memory address the limitations of physical memory? **(5)**

(b) Discuss the binary subtraction process and describe how borrow is handled in binary subtraction. **(5)**

****

(Please write your Exam Roll No.) Exam Roll No. 03117716023

END TERM EXAMINATION

THIRD SEMESTER [B.TECH] DECEMBER 2024

Paper Code: ECC-209 **Subject: Analog communication**

Time: 3 Hours **Maximum Marks: 60**

Note: Attempt any five questions including Q.No.1 which is compulsory. Assume missing data, if any.

Q1 Attempt **any four** of the following questions: **[4x5=20]**

a) What do you mean by convolution theorem in association with Fourier Transform. Prove Time convolution and frequency convolution.

b) Explain the difference between single-sideband (SSB) and vestigial-sideband (VSB) modulation.

c) Define Probability and Random Variables in the context of communication systems. Given a random process with zero mean and variance of 4, calculate its probability density function (PDF) assuming it's Gaussian.

d) What is the role of a Superheterodyne Receiver? Explain with a diagram. Also in a given system, if the carrier frequency is 900 kHz and the intermediate frequency is 455 kHz, calculate the local oscillator frequency required for proper reception.

e) Explain the significance of the Power Spectral Density (PSD) in analyzing random processes.

f) Compare Narrowband Noise and Wideband Noise in communication systems. If the noise power in a system is 0.5W, and the system's bandwidth is 100 kHz. Calculate the noise figure of the system.

g) Describe the process of Pre-emphasis and De-emphasis in FM systems and their importance.

h) Derive the expression for the output signal-to-noise ratio (SNR) in an AM receiver.

Q2 Describe the communication process in detail. Explain how Fourier transforms are used in communication systems, and discuss the significance of Dirac Delta functions in signal analysis. Also, in an AM system if the carrier amplitude is 5V, and the modulating signal amplitude is 3V. Calculate the modulation index and draw the modulated signal's spectrum. **[10]**

OR

Q3 Explain Double Sideband-Suppressed Carrier (DSB-SC) modulation. Derive the mathematical expression and discuss the advantages of this modulation scheme compared to standard AM. **[10]**

Q4 Define Frequency Modulation (FM). Derive the expression for the frequency deviation in an FM signal and discuss the difference between narrowband FM and wideband FM.A 100 MHz carrier is frequency modulated by a 5 kHz sine wave, resulting in a frequency deviation of 25 kHz. Calculate the bandwidth using Carson's Rule. **[10]**

OR

Q5 What is a Phase-Locked Loop (PLL)? Explain its working principle and how it is used in FM demodulation with the help of a block diagram. **[10]**

P.T.O.

Q6 Define and explain the concept of a Random Process. Discuss the role of Correlation and Covariance functions in the analysis of random processes. **[10]**

OR

Q7 A random process passes through a linear filter. Explain how the Power Spectral Density (PSD) of the process is affected. Include the importance of Gaussian processes in this context. **[10]**

Q8 Discuss the types of noise encountered in FM receivers. How does noise affect the signal quality, and what are the techniques used to minimize it? **[10]**

OR

Q9 Explain the Noise Figure of a receiver. Derive the expression for Noise in a Double Sideband-Suppressed Carrier (DSB-SC) receiver and discuss how noise affects system performance. If in the receiver model of noise in DSB-SC receivers, the signal power is 2W and the noise power is 0.2W, calculate the signal-to-noise ratio (SNR) and comment on the system's performance. **[10]**

****

(Please write your Exam Roll No.)

VLSI

Exam Roll No. 04017716

END TERM EXAMINATION

THIRD SEMESTER [B.TECH] DECEMBER 2024-JANUARY 2025

Paper Code: ECC-211 **Subject: Analog Electronics-I**

Time: 3 Hours **Maximum Marks: 60**

Note: Attempt five questions in all including Q. No.1 which is compulsory. Select one question from each unit. Assume missing data, if any.

Q1 Attempt **all** questions:- **(5x4=20)**

(a) Draw a Darlington pair and find out it's current gain.

(b) Explain how Zener diode maintains constant voltage across the load?

(c) The output of a 60 Hz full wave bridge rectifier has a 60 Hz ripple. Is the circuit working properly.

(d) Why emitter is always forward biased? Why collector is always reverse biased w.r.t base.

(e) An amplifier with voltage gain of 60 dB uses 1/20 of its output in negative feedback. Calculate the gain with feedback in dB.

(f) A transformer coupled class A large signal amplifier has maximum and minimum values of collector-emitter voltage of 25V and 2.5V. Determine its collector efficiency?

UNIT-I

Q2 (a) Draw the piecewise linear equivalent circuit of diode and explain it briefly. Explain the effect of temperature on the V-I characteristics of diode. **(4)**

(b) In a centre tap full wave rectifier R_L = 1000 ohm, R_f = 35 ohm. Primary voltage is 220V 50Hz with transformer ratio 5:1. Calculate (i) Average current (ii) d.c output voltage (iii) d.c output power (iv) a.c input power and (v) rectifier efficiency. **(3)**

(c) What are the two basic types of capacitances associated with P-N junction? Explain them. **(3)**

OR

Q3 (a) A voltage across a silicon diode at room temperature of 300K is 0.71V when 2.5 mA current flows through it. If the voltage increases to 0.8V, calculate the new diode current. **(2)**

(b) Draw the circuit diagram of a bridge rectifier and explain its operation with waveforms. Derive expression for its rectification efficiency and ripple factor. **(4)**

(c) Design a clipping circuit to clip a sinusoidal wave of 2V peak voltage at 100 Hz above +1 volt. Draw input and output waveforms. **(4)**

UNIT-II

Q4 (a) What is self bias? Derive the expression for stability factor S(Ico) for self bias circuit. Draw the graph of variation of S(Ico) with change in R_B/R_E. **(5)**

(b) Draw the hybrid equivalent circuit for common emitter configuration and find expression for current gain, voltage gain, input impedance, output impedance. **(5)**

OR

P-1/2

P.T.O.

Q5 (a) Design a self bias circuit for C.E. amplifier having β=99 and stability S=5. The other values are V_{CE} = 6V, V_{RE} =5.5V, V_{CC} = 15V, R_C =2.5k ohm and V_{BE}=0.3V. (5)

(b) Draw the structure of an N- channel enhancement type MOSFET. Explain it's working with the help of drain characteristics and transfer characteristics. (5)

UNIT-III

Q6 (a) Discuss class B power amplifier and calculate its overall efficiency. (5)

(b) A class B push pull amplifier is supplied with V_{cc}=50V. The signal swings the collector voltage down to V_{min}=5V. The total dissipation in both transistors is 40W. Find the total power and conversion efficiency. (5)

OR

Q7 (a) Draw the circuit diagram of two stage R-C coupled amplifier. Derive an expression for the voltage gain in mid-frequency region. (5)

(b) Explain the need for a multistage amplifier. Draw the circuit of a cascode amplifier and explain its operation. (5)

UNIT-IV

Q8 (a) Why is negative feedback involved in high gain amplifiers. Prove in a negative feedback amplifier $\frac{dA_f}{A_f} = \frac{1}{1+\beta A}\frac{dA}{A}$ where A_f is Gain with feedback, A is gainwithout feedback and β is feedback factor. (5)

(b) What is piezoelectric effect? Draw the equivalent electric circuit of a quartz crystal and find the expression for resonant frequencies. (5)

OR

Q9 (a) Explain the four types of feedback topologies with the help of schematic diagram. (6)

(b) Describe Hartley oscillator circuit and explain its action. (2)

(c) Find the operating frequency of a transistor Collpitt's oscillator if C1=0.001μF, C2=0.01μF and L=15μH. (2)

****

P-2/2