MA8352/LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS

Assignment Questions

1. Consider $V = \{p(x) = a_0x^2 + a_1x + a_2 / a_0, a_1, a_2 \ are\ real\ numbers\}$ the set of all polynomials of degree ≤ 2. Then V is a vector space over F under usual addition and multiplication.
2. Let $V = \{a + b\sqrt{2} / a, b \in Q\}$. Then V is a vector space over Q under usual addition and multiplication.
3. If V(R) be the vector space of all 2×2 matrices over the real field R. Show that the subset V consist of all matrices A for which $A^2 = A$ is not a subspace of V(R).
4. Let $V_n(R)$ be the vector space over the field of real numbers ($n \geq 3$), Define $W = \{(a_1, a_2, \dots, a_n): a_i \in R, i = 1,2, \dots, n$ and $a_1 a_2 = 0\}$. Check whether W(R) constitutes a subspace of $V_n(R)$.
5. Let $V_n(R)$ be the vector space over the field of real numbers ($n \geq 3$), Define $W = \{(a_1, a_2, \dots, a_n) \in R^n: a_i \in R, i = 1,2, \dots, n$ and $a_2 = a_1^2\}$. Check whether W(R) forms a subspace of $V_n(R)$.
6. Check The polynomial $3x^3 - 2x^2 + 7x + 8$ is a linear combination of $x^3 - 2x^2 - 5x - 3$ and $3x^3 - 5x^2 - 4x - 9$ in $P_3(R)$
7. Find a linear span of S in the following cases: (i) $S = \{(1,0), (0,1)\}$ in $V_2(R)$. (ii) $S = \{(1,0,0), (2,0,0), (3,0,0)\}$ in $V_3(R)$.
8. Is the vector $(2,-5,3)$ in the subspace of $V_3(R)$ spanned by the vectors $(1,-3,2), (2,-4,-1), (1,-5,7)$.
9. Let $S = \{(1,-1,2), (2,3,1), (4,5,6)\}$ be a subset of $V_3(R)$. Prove that S is linearly independent.
10. For what value of k, the set $\{(2,-1,3), (3,4,-1), (k, 2,1)\}$ becomes linearly independent.
11. Let {u,v,w,z} be a set of linearly independent vectors of a vector space. Check, whether the set $S = \{u - 3z, v + 2u, 2v - w, w + z\}$ is linearly independent.
12. Show that the vectors (1,1,0,0), (0,1,-1,0),(0,0,0,3) in $V_4(R)$ are linearly independent.
13. Show that the set $\{1, x, x(1 - x)\}$ is a linearly independent set of vectors in the space of all polynomials over the real number field.
14. Show that the set $\{1, x, 1 + x + x^2\}$ is a linearly independent set of vectors in the space of all polynomials over the real number field.
15. Show that the following vectors form a basis for $V_3(R)$
    (1,1,0),(0,1,1),(1,0,1)
16. Show that the following vectors form a basis for $V_3(R)$
    (2,-3,1)(0,1,2)(1,1,2).
17. Examine whether or not the following vectors forms a basis of $V_3(R)$, (1,1,2), (1,2,5), (5,3,4).
18. Tell with reason whether or not the vectors (2,1,0),(1,-1,0) and (4,2,0) forms a basis of $V_3(R)$.
19. Show that the set $S = \{1, x, x^2, \dots, x^n\}$ of (n+1) polynomial in x is a basis of the vector space $P_n(R)$ of all polynomial in x over a field of real numbers.
20. Under what conditions on the scalar 'a' are the vectors (a,1,0), (1,a,1) and (0,1,a) in $V_3(R)$ linearly dependent.
21. In $V_3(R)$ where R is the field of real numbers, examine each of the following set of vectors for linear dependence. $S = \{(1,2,0), (0,3,1), (-1,0,1)\}$.
22. In $V_3(R)$ where R is the field of real numbers, examine each of the following set of vectors for linear dependence. $S = \{(1,3,2), (1,-7,-8), (2,1,-1)\}$.

23. In $V_3(R)$ where R is the field of real numbers, examine each of the following set of vectors for linear dependence. $S = \{(1,2,1),(3,1,5),(3,-4,7)\}$.

24. Determine whether the following set of vectors in $V_3(Q)$ is linearly dependent or independent; Q being the field of quotients, $S = \{(-1,2,1),(3,1,-2)\}$.

25. Prove that the set of all polynomials over a field F is a vector space V.

26. Let V be the set of sequences $\{a_n\}$ of real numbers. For $\{a_n\},\{b_n\} \in V$ and any real number t, define $\{a_n\} + \{b_n\} = \{a_n + b_n\}$ and $t\{a_n\} = \{ta_n\}$. Prove that with these operations, V is a vector space over R.

27. Prove that $W_1 = \{(a_1, a_2, \ldots, a_n) \in F^n : a_1 + a_2 + \cdots + a_n = 0\}$ is a subspace of F^n but $W_2 = \{(a_1, a_2, \ldots, a_n) \in F^n : a_1 + a_2 + \cdots + a_n = 1\}$ is not.

28. Show that the set $W = \{(a_1, a_2, \ldots, a_n) \in R^3 : a_1 = 3a_2 \ and \ a_3 = -a_2\}$ is a subspace of R^3.

29. Show that the set $W = \{(a_1, a_2, \ldots, a_n) \in R^3 : 5a_1^2 - 3a_2^2 + 6a_3^2 = 0\}$ is not a subspace of R^3.

30. Let V= R^3. Show that set $W = \{(a,b,c) : a^2 + b^2 + c^2 \leq 1\}$ is not a subspace of V.

31. Let V denote the set of all $m \times n$ matrices with real entries. Let F be the field of rational numbers, defined by for all $A, B \in M_{m\times n}(F)$ and $c \in F$; $(A+B)_{ij} = A_{ij} + B_{ij}$ ………(1) and $(cA)_{ij} = cA_{ij}$…………(2). Is V a vector space over F?

32. Prove that the set of all polynomials over a field F is a vector space V.

33. Prove that $W_1 = \{(a_1, a_2, \ldots, a_n) \in F^n : a_1 + a_2 + \cdots a_n = 0\}$ is a subspace of F^n but $W_2 = \{(a_1, a_2, \ldots, a_n) \in F^n : a_1 + a_2 + \cdots a_n = 1\}$ is not.

34. Show that the set $W = \{(a_1, a_2, a_3) \in R^3 : a_1 = 3a_2 \ and \ a_3 = -a_2\}$ is a subspace of R^3.

35. Show that the set $W = \{(a_1, a_2, a_3) \in R^3 : 5a_1^2 - 3a_2^2 + 6a_3^2 = 0\}$ is not a subspace of R^3.

36. Let $V = R^3$. Show that the set $W = \{(a,b,c) \in R^3 : a^2 + b^2 + c^2 \leq 1\}$ is not a subspace of V.

37. If W be a subspace of a vector space V over a field F, prove that v +W is a subspace of V if and only if $v \in W$.

38. Let W be a subspace of a vector space over a field F. Prove that $v_1 + W = v_2 + W$ if and only if $v_1 - v_2 \in W$.

39. Show that if $v_1 + W = v_1' + W$ and $v_2 + W = v_2' + W$, then $(v_1 + W) + (v_2 + W)$= $(v_1' + W) + (v_2' + W)$ and $(v_1 + W) = a(v_1' + W)$ for all $a \in F$.

40. Prove that the set S is a vector space with the operations defined $(v_1 + W) + (v_2 + W)$= $(v_1' + W) + (v_2' + W)$ and $(v_1 + W) = a(v_1' + W)$ for all $a \in F$. This vector space is called the quotient space of V modulo W and is denoted by V/W.

41. Show that if S_1 and S_2 are arbitrary subsets of a vector space V, then span$(S_1 \cup S_2) = span(S_1) + span(S_2)$.

42. In $M_{2\times 3}(F)$, prove that the set $\left\{\begin{pmatrix}1 & 1\\ 0 & 0\\ 0 & 0\end{pmatrix}, \begin{pmatrix}0 & 0\\ 1 & 1\\ 0 & 0\end{pmatrix}, \begin{pmatrix}0 & 0\\ 0 & 0\\ 1 & 1\end{pmatrix}, \begin{pmatrix}1 & 0\\ 1 & 0\\ 1 & 0\end{pmatrix}, \begin{pmatrix}0 & 1\\ 0 & 1\\ 0 & 1\end{pmatrix}\right\}$ is linearly dependent.

43. The set of diagonal matrices in $M_{2\times 2}(F)$ is a subspace. Find a linearly independent set that generates this subspace.

44. In F^n, let e_j denote the vector whose j^{th} coordinate is 1 and whose other coordinates are 0. Prove that $\{e_1, e_2, \ldots, e_n\}$ is linearly independent.

45. Let S be a set of non-zero polynomials in P(F) such that no two have the same degree. Prove that S is linearly independent.

46. Let S be a linearly independent subset of a vector space V, and v be a vector in V that is not in S. Then $S \cup \{v\}$ is linearly dependent if and only if $v \in span(S)$.

47. Let $S = \{u_1, u_2, \ldots, u_n\}$ be a finite set of vectors. Prove that S is linearly dependent if and only if $u_1 = 0$ or $u_{k+1} \in span(\{u_1, u_2, \ldots, u_k\})$ for some $k(1 \leq k < n)$.

48. The set of all skew-symmetric $n \times n$ matrices is a subspace W of $M_{n\times n}(F)$. Find a basis for W. What is the dimension of W?

49. The vectors $u_1 = (2,-3,1), u_2 = (1,4,-2), u_3 = (-8,12,-4), u_4 = (1,37,-17)$, and $u_5 = (-3,-5,8)$ generate R^3. Find a subset of the set $\{u_1, u_2, u_3, u_4, u_5\}$ that is a basis for R^3.

50. Let W_1 and W_2 be the subspaces of P(F). Determine the dimensions of the subspaces $W_1 \cap P_n(F)$ and $W_2 \cap P_n(F)$.

51. Let $T: V_3(R) \to V_2(R)$ by $T(a_1, a_2, a_3) = (a_1 - a_2, a_3)$. Check T is linear.

52. Let $T: V_3(R) \to V_2(R)$ be the linear transformation defined by $T(a_1, a_2, a_3) = (a_1 - a_2, 2a_3)$. Find N(T) and R(T).

53. Let $T: V_2(R) \to V_3(R)$ be a mapping defined by $T(a, b) = (a + b, a - b, b)$. Show that T is a linear transformation from $V_2(R)$ to $V_3(R)$. Find the range space and null space of T and also N(T). i.e., nullity of T.

54. For the following linear operator T on a vector space V and ordered basis β, compute $[T]_\beta$ and determine whether β is a basis consisting of eigen vectors of T. $V = P_1(R)$, $T(a + bx) = (6a - 6b) + (12a - 11b)x$ and $\beta = \{3 + 4x, 2 + 3x\}$.

55. Find the eigenvalues and eigenvectors of the matrix $A = \begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}$.

56. Find the eigenvalues and eigenvectors of the matrix $\begin{pmatrix} 6 & -6 & 5 \\ 14 & -13 & 10 \\ 7 & -6 & 4 \end{pmatrix}$.

57. Find the eigenvalues and eigenvectors of the matrix $A = \begin{pmatrix} a & b \\ -b & a \end{pmatrix}$

58. Let T be the linear operator on P_2(R) defined by $T(f(x)) = f(1) + f'(0)x + (f'(0) + f''(0))x^2$ and $\beta = \{1, x, x^2\}$ be the standard basis. Test the diagonalizability of T.

EC8394 FUNDAMENTALS OF DATA STRUCTURES IN C

Assignment Questions

1 C program to find sum of array elements using Dynamic Memory Allocation.

2	C program to print weekday of given date.
3	C program to design a TIC TAC TOE game.
4	C program to design flying characters Screen Saver.
5	C program to remove consecutive repeated characters from string.EMI Calculator.
6	C Program to find the sum of digits of a number until a single digit is occurred.
7	Create a array of structure to accept and display the values of 10 employees.
8	Create a structure to store the employee number, name, department and basic salary.
9	Following is the menu to be displayed to the user. On selecting a choice display appropriate result. Number should be accepted from the user. Menu 1. Prime Factors 2. Leap Year 3. Sum of all digits 4. Number in reverse order
10	C Program to Find the Biggest Number in an Array of Numbers using Recursion
11	Display number of even values stored in an array.
12	Display sum of all odd values stored in an array.
13	Perform the following operations on integer array of 10 elements. Accept the values from user and sort an array in ascending order.
14	C Program to Implement Hash Tables chaining with Singly Linked Lists.
15	C Program to Implement Hash Tables Chaining with Binary Trees.
16	C Program to Implement Hash List.
17	C Program to Implement Adjacency Matrix.
18	C Program to Implement Queue Using Two Stacks.
19	Implement stack and perform push, and pop operations.
20	Program for Circular Queue implementation through Array.
21	Reversal of a singly link list by recursion.
22	Queue implementation using single linked list.
23	Basic binary search tree routines.
24	Find in-order Successor and Predecessor in a BST using C program.
25	Write a C program to addition, subtract and multiply two matrices.
26	1. Write a C program to scaling transformations of a matrix. 2. Write a C program to determinant a matrix.
27	1. Write a C program to transpose a matrix. 2. Write a C program to find mean, median and mode.
28	C program to find sum of array elements using Dynamic Memory Allocation.
29	C program to print weekday of given date.
30	C program to design a TIC TAC TOE game.
31	C program to design flying characters Screen Saver.
32	C program to remove consecutive repeated characters from string. EMI Calculator.
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47	Program for Circular Queue implementation through Array.
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51	Find in-order Successor and Predecessor in a BST using C program.
52	Write a C program to addition, subtract and multiply two matrices.
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54	1. Write a C program to transpose a matrix. 2. Write a C program to find mean, median and mode.
55	C program to find sum of array elements using Dynamic Memory Allocation.
56	C program to print weekday of given date.

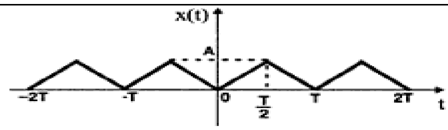
EC 8351-ELECTRONICS CIRCUITS-I

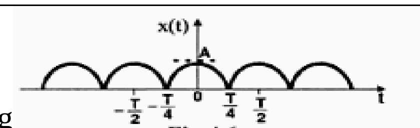
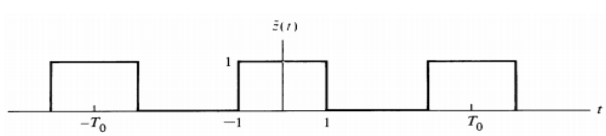
1	Voltage Multiplier
2	Envelope detector
3	Half wave voltage doublers
4	Full Wave voltage doublers
5	Three phase half wave rectifier
6	Six phase half wave rectifier
7	Voltage Tripler
8	Quadroupler
9	Chopper Power Supply
10	TV Horizontal voltage supply
11	Transistor Manufacturing Techniques
12	Thermistor applications
13	Three channel audio mixer using FET amplifier.
14	Square wave generator using Zener
15	JFET Voltmeter
16	MOSFET relay driver
17	Audio mixer using BJT
18	Random noise generator using BJT

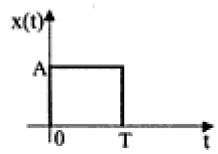
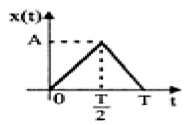
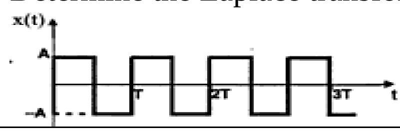
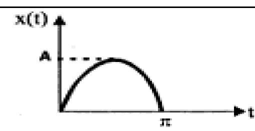
19	Preamplifier using BJT
20	Logic gates using BJT
21	Decibel, Bandwidth
22	Current mirror using BJT
23	Voltage level indicator using BJT
24	Speaker frequency response
25	Why frequency response is important?
26	Series pass voltage regulator
27	Different types of transistors and their functions
28	Microphone’s frequency response and its importance.
29	Heat sink
30	Sensistor
31	Miller effect and Miller capacitance
32	General frequency response of a coupling capacitor.
33	General frequency response of a bypass capacitor.
34	General frequency response of a load capacitor.
35	Zener diode voltage reference circuit
36	Concept of DC load line
37	Concept of AC load line
38	Power transistors
39	Power amplifiers
40	How differential mode output signal is generated.
41	How Common mode output signal is generated.
42	Two general types of feed back
43	NMOS three input NOR logic gate
44	NMOS three input NAND logic gate
45	Floating gate MOSFET
46	How BJT is used in digital application.
47	Positive voltage regulator
48	Negative voltage regulator
49	Reasons for keeping the operating point of a transistor are fixed.
50	How will you determine h-parameters of a transistor experimentally?
51	Outline the process sequence of fabrications of MOSFET.
52	Transistor as an amplifier
53	Negative feedback and positive feed back
54	Transistor shunt voltage regulator
55	Transistorized series voltage regulator
56	Inverting switching regulator.

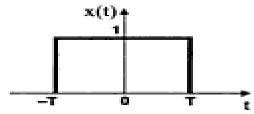
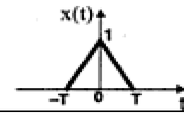
EC 8352-SIGNALS AND SYSTEMS

S. No.	Assignment Questions
1	Find the Fourier series of the waveform shown in fig

S. No.	Assignment Questions
	
2	Realize the system given by difference equation y(n)=-0.1y(n-1)+0.72y(n-1)+0.7x(n)-0.252x(n-2) in direct form I, direct form II, cascade and parallel form
3	Find whether the following signal $x(t) = 2\cos(10t + 1) - \sin(4t - 1)$ is periodic or not. ii. Find the summation iii. Explain the properties of unit impulse function. iv. Find the fundamental period T of the continuous time signal. $x(t) = 20\cos(10\pi t + \pi/6)$
4	1.Check the following for linearity, time invariance, causality and Stability. $y(n) = x(n) + nx(n+1)$ 2.Check whether the following are periodic. $x[n] = \sin\left(\left(\frac{6\pi n}{7} + 1\right)\right)$ $x(n) = e^{j3\pi/5(n+\frac{1}{5})}$
5	Find the impulse response of the discrete time system described by the difference equation y(n-2)-3y(n-1)+2y(n)=x(n-1)
6	Find the impulse response of the system. a) $H(s) = \frac{1}{s^2(s+\sqrt{2})}$ b) $H(s) = \frac{4}{s(s^2-16)}$ c) $H(s) = \frac{3}{s^2+18s+90}$
7	Determine the Power and Energy of the following signals a) $x(t) = 0.9\, e^{-3t}\, u(t)$ b) $x(t) = 3\, e^{-j0.5\pi t}$ c) $x(t) = 1.2 \sin 7\Omega t$
8	1. For the following signals, (i) determine analytically which are periodic (if periodic, give the period) a) $x(t) = 4\cos(8\pi t)$ b) $x(t) = 4\sin(5\pi t - \pi/4)$ c) $x(t) = 3u(t) + 2\sin(3t)$ 2. Determine if the following signals are periodic; if periodic, give the period. a) $x(t) = \sin(4t) + 2\cos(8t)$ b) $x(t) = 2\cos(3t) + 3\sin(7t)$

S. No.	Assignment Questions
9	Verify the following systems are i) Static or dynamic ii) Linear or non linear iii) Time invariant or variant iv) Causal or non causal a) $y(t) = x(t) cos\, 100\pi t$ b) $\frac{dy(t)}{dt} + 10y(t) = x(t)$ c) $y(t) = x^2(t)$ d) $y(t) = e^{x(t)}$ e) $y(n) = x(n)u(n)$ f) $y(n) = cos\, x(n)$ g) $y(n) = x(-n+2)$
10	Determine the whether the systems described the i/p o/p equations are linear, time invariant, dynamic and stable. i. $y1(t) = x(t- 3) + (3 - t)$ ii. $y_2(t) = \frac{dx(t)}{dt}$ iii. $y1[n] = nx[n] + bx^2[n]$ iv. $Eve\{x[n - 1]\}$
11	Find the Fourier series of the waveform shown in fig 
12	Obtain Fourier series of half wave Rectified Sine wave.
13	1. Determine the power and RMS value of the following signals. $x(t) = 5cos\,(50t+ \pi/3)$ $x(t) = 10cos5tcos10t$ 2. Sketch the following signals. i. x(t) = r(t) ii. x(t) = r(-t+2) iii. x(t) = -2r(t) where r(t) is the ramp signal.
14	Find the Fourier series of the waveform shown in fig. 
15	Find the Fourier transform of the time domain signals given below. i. $X(t) = t \sin \Omega_0 t$; t=0 to ∞ ii. $X(t) = t \cos \Omega_0 t$; t=0 to ∞

S. No.	Assignment Questions
16	Determine the Fourier transform of the rectangular pulse shown in fig. 
17	Determine the Fourier transform of the triangular pulse shown in fig. 
18	Determine the Laplace transform of the periodic signal shown in fig. 
19	Determine the initial value and final value for the following signals using initial and final value theorems. i. $X(S) = \frac{1}{s(s-1)}$ ii. $X(S) = \frac{s+1}{s^2+2s+2}$ iii. $X(S) = \frac{7s+6}{s(3s+5)}$
20	Determine the Laplace transform of the signal show 
21	Determine the even and odd part of the signals. a) $x(t) = e^{j2t}$ b) $x(n) = 4 + 2e^{3n}$ c) $x(t) = t + 3t^2 + Cos^2 t$ d) $x(n) = sin^2 n + e^{j5\pi n}$
22	Perform the convolution of the given signals. **a)** $x_1(t) = t^2 u(t)$; $x_2(t) = u(t-1)$ **b)** $x_1(t) = te^{-4t}u(t)$; $x_2(t) = u(t)$ **c)** $x_1(t) = t\,u(t)$; $x_2(t) = \sin t\,u(t)$
23	Determine the Fourier transform of the following signals. a) $x(t) = 1 - t^2$; for $\lvert t\rvert < 1$ b) $x(t) = e^{-at}\cos\Omega_0 t\,u(t)$ $= 0$; for $\lvert t\rvert > 1$
24	Determine the Fourier transform of the following signals shown in fig.

S. No.	Assignment Questions
	 
25	Find Laplace and ROC of the signals. **a)** $x(t)=\left(t^2+2t+4\right)u(t)$ **b)** $x(t)=\cos^2 6t\, u(t)$ **c)** $x(t)=e^{-5t}\sin 7t\, u(t)$ **d)** $x(t)=e^{at+b}\, u(t)$
26	i) Find the Laplace Transform and ROC of the signal $x(t) = e^{at}\, u(t) + e^{bt}\, u(t)$
27	Find the inverse Laplace transform of $(s) = \frac{2s^2+5s+5}{(s+1)^2(s+2)}$ Re{s}>-1 Determine the initial value and final value of signal x(t) whose Laplace Transform is, $X(s) = \frac{2s+5}{s(s+3)}$
28	Find the Fourier Transform of the Triangular Function. Obtain inverse Laplace Transform of the function , ROC: -2< Re{s} <-1
29	Solve the differential equation: $\frac{d^2y(t)}{dt} + 4\frac{dy(t)}{dt} + 5y(t) = 5x(t)$ and x(t) = u(t)
30	Determine the impulse response h(t) of the system given by the differential equation $\frac{d^2y(t)}{dt^2}+3\frac{dy(t)}{dt}$ 2y(t) = x(t) with all initial conditions to be zero.
31	Determine the Fourier transform of the x(n) where x(n) is given by, $x(n) = 1 \;;\; 0 \le n \le 4$ $= 0 \;;\;$ otherwise
32	Determine the Fourier transform of the x(n) where x9n) is given by, $x(n) = a^{\lvert n \rvert} \;;\; -1 < a < 1$
33	Find the transfer function of the LTI system using DTFT. y(n)-0.5y(n-1)=x(n)+0.4x(n-1)
34	An LTI system is given by y(n)= -2y(n-2)-0.5y(n-1)+3x(n-1)+5x(n) Find transfer function.
35	Using laplace transform, find the impulse response of an LTI system described by the differential equation. $\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 2y(t) = x(t)$
36	Find the laplace transform of the signal. $x(t) = e^{-at}u(t) + e^{-bt}u(-t)$ Find the Fourier transform of $x(t) = e^{-\lvert t \rvert}\, for -1 \le t \le 1$ = 0 otherwise
37	Realize the following in direct form II $\frac{d^3y(t)}{dt^3} + 4\frac{d^2y(t)}{dt^2} + 7\frac{dy(t)}{dt} + 8y(t) = 5\frac{d^2x(t)}{dt^2} + 4\frac{dx(t)}{dt} + 7x(t)$
38	Find the Convolution of the following signals.

S. No.	Assignment Questions
	$x(t) = e^{-2t}u(t)$ and $h(t) = u(t+2)$
39	Obtain the convolution of the following two signals? X(t)= u(-t) h(t) = u(t-3)
40	A Discrete time System is given as y(n) = y2(n-1) = x(n). A bounded input of $(n) = 2(n)$ is applied to the system. Assume that the system is initially relaxed. Check whether the system is stable or unstable.
41	Find the impulse and step response of the following system y(n)-3/4y(n-1)+1/8y(n-2)=x(n)
42	Obtain the cascade and parallel form realization of the following system y(n)-1/4y(n-1)-1/8y(n-2)= x(n)+3x(n-1)+2x(n-2)
43	A discrete time causal system has a transfer function $H(Z)= (1-Z^{-1}) / (1-0.2Z^{-1}-0.15Z^{-2})$ i) Determine the difference equation of the system ii)Show pole zero diagram iii)Find the impulse response
44	Obtain the cascade realization of Y(n)-1/4y(n-1)-1/8y(n-2)=x(n)+3x(n-1)+2x(n-2)
45	Determine the system function and impulse response of the causal LTI system Defined by the difference equation Y(n)-1/2y(n-1)+1/4y(n-2)=x(n) Using Z transform, determine y(n) if x(n)=u(n).
46	Determine the response of the LTI system whose input $x(n) = \{\underset{\uparrow}{1},2,3,1\}$ and $h(n) = \{\underset{\uparrow}{1},2,1,-1\}$ using matrix method and verify by tabular method.
47	1.Convolve the following two sequences x(n) ={1,1,1,1} and h(n) ={3,2}. 2.Convolve $x(n) = \{1,1,\underset{\uparrow}{0},1,1\}$ and $h(n) = \{1,-2,-3,\underset{\uparrow}{4}\}$
48	A system has impulse response and it is given by h(n), h(n)= -0.25δ(n+1)+0.5δ(n)-0.25 δ(n-1) a) Is BIBO stability? b) Is causal? c) Find frequency response.
49	1.Find the impulse response of the system. y(n) -3y(n-1) -4y(n-2) = x(n) +2x(n-1) 2.The impulse response of the LTI system is given $h(n) = 0.6^n u(n)$. Find the frequency response.
50	Defined by the difference equation Y(n)-1/2y(n-1)+1/4y(n-2)=x(n) Using Z transform, determine y(n) if x(n)=u(n).
51	Find DFT of a sequence using DIT algorithm X(n)={0.5,0,0.5,0,0.5,0,0.5,0}

S. No.	Assignment Questions
52	Find DFT of the sequence x(n)={1,2,3,2,1,2,3,2} using DIF algorithm
53	Compute IDFT of the sequence X(k)={7,-0.707-j0.707,-j,0.707-j0.707,1,0.707+j0.707,j,-0.707+j0.707}
54	By using long division method determine inverse z transform of $X(z)=(1+2z^{-1})/(1-2z^{-1}+z^{-2})$
55	Find the inverse Z transform of the following using Residue method X(z)=(2z-^{1})/$(1-1/4z^{-1})^{2}$ ROC: |z|>1/4

EC 8392-Digital Electronics

1	Design a combinational circuit that accepts a 3 bit binary number as input and generates an output binary number equal to the square of the input number.
2	Determine the minimal function that can detect a "divisible by 3" 8421 BCD code.
3	1. Implement a circuit which gives 4-bit equality condition. 2. The output of a 2-bit comparator is logic 1 whenever the 2 bit input A is greater than the 2 –bit input B. Determine the number of combination for which the output is logic 1?
4	(i) How many 128× 8 RAM chips are required to provide a memory capacity of 2048 bytes. (ii) How many lines of address bus must be used to access 2048 bytes of memory. How many lines of these will be common to each chip? (iii) How many bits must be decoded for chip select? What is the size of decoder? (iv)Distinguish between min terms and max terms.
5	Design a code converter that converts a decimal digit from (a) The 8, 4, –2, –1 code to BCD. (b) The 8, 4, –2, –1 code to Gray code.
6	1. What are universal gates. Construct a logic circuit using NAND gates only for the expression x =A .(B + C). 2. Discuss in detail, the working of Full Adder logic circuit and extend your discussion to explain a binary adder, which can be used to add two binary numbers.
7	What is a flip-flop? What is the difference between a latch and a flip-flop? List out the application of flip-flop.
8	Construct a 5-to-32-line decoder with four 3-to-8-line decoders with enable and a 2-to- 4-line decoder
9	1.What is an encoder? Draw the logic circuit of Decimal to BCD encoder and explain its working. 2.What is a flip-flop? What is the difference between a latch and a flip-flop? List out the application of flip-flop.
10	Using a suitable logic diagram explain the working of a 1-to-16 de multiplexer
11	1.What are synchronous counters? Design a Mod-5 synchronous counter using J-K Flip-Flops. 2.What is a shift register? Can a shift register be used as a counter? If yes, explain how?
12	1.Design a combinational circuit that compares two 4-bit numbers to check if they are equal. The circuit output is equal to 1 if the two numbers are equal and 0 otherwise.

2.Design a BCD-to-decimal decoder using the unused combinations of the BCD code as don’t-care conditions.

13 Draw the circuit diagram of a Master-slave J-K flip-flop using NAND gates. What is race around condition? How is it eliminated in a Master-slave J-K flip-flop.

14 Distinguish between ROM, PROM, EPROM, EEPROM.
Difference between static and dynamic RAM. Draw the circuits of one cell of each and explain its working.

15 1.Convert the octal number 7401 to Binary.
2. Find the hex sum of $(93)_{16} + (DE)_{16}$.
3. Perform 2’s complement subtraction of $(7)_{10} - (11)_{10}$.

16 1.A combinational circuit is specified by the following three Boolean functions:
$F1(A, B, C) = \sum (1, 4, 6)$ $F2(A, B, C) = \sum (3, 5)$
$F3(A, B, C) = \sum (2, 4, 6, 7)$
2.Implement the circuit with a decoder constructed with NAND gates and NAND or AND gates connected to the decoder outputs. Minimize the number of inputs in the external gates.

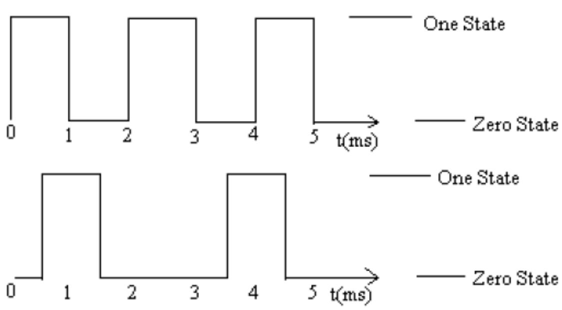
17 1.Evaluate x = A.B+ C(A.D) using the convention A = True and B = False.

2.Simplify the Boolean expression F = C(B + C)(A + B + C).

18 1.Design a combinational circuit that compares two 4-bit numbers to check if they are equal. The circuit output is equal to 1 if the two numbers are equal and 0 otherwise.
2.Construct a 5-to-32-line decoder with four 3-to-8-line decoders with enable and a 2-to-4-line decoder.

19 Design a BCD to seven segment decoder that accepts a decimal digit in BCS and generates the appropriate output for segments in display indicator.

20 The voltage waveforms shown in Fig.1 are applied at the inputs of 2-input AND and OR gates. Determine the output waveforms.



21 1.Simplify the following expression into sum of products using Karnaugh map
$F(A,B,C,D)= \sum m (1,3,4,5,6,7,9,12,13)$
2. Implement a full adder with two 4 : 1 multiplexers.

22 A staircase light is controlled by two switches one at the top of the stairs and another at the bottom of stairs
(i) Make a truth table for this system.
(ii) Write the logic equation is SOP form.
(iii) Realize the circuit using AND-OR gates.

23 1.Minimize the following logic function using K-maps and realize using NAND and NOR gates.

F(A,B,C,D)= ∑m(1,3,5,8,9,11,15) + d(2,13)

2.Design a 4 to 1 Multiplexer by using the three variable function given by F(A,B,C) = ∑m(1,3,5,6)

1.Using a decoder and external gates, design the combinational circuit defined by the following three Boolean functions:

(a) $F_1 = x'yz' + xz$
$F_2 = xy'z' + x'y$
$F_3 = x'y'z' + xy$

(b) $F_1 = (y' + x)z$
$F_2 = y'z' + x'y + yz'$
$F_3 = (x + y)z$

24 2.Implement the following Boolean function with a 4 :1 multiplexer and external gates.

(a)* $F_1(A, B, C, D) = \Sigma(1, 3, 4, 11, 12, 13, 14, 15)$

(b) $F_2(A, B, C, D) = \Sigma(1, 2, 5, 7, 8, 10, 11, 13, 15)$

Connect inputs *A* and *B* to the selection lines. The input requirements for the four data lines will be a function of variables *C* and *D* . These values are obtained by expressing *F* as a function of *C* and *D* for each of the four cases when *AB* = 00, 01, 10, and 11. These functions may have to be implemented with external gates.

1.A combinational circuit has 3 inputs A, B, C and output F. F is true for following input combinations

A is False, B is True

A is False, C is True

A, B, C are False

A, B, C are True

25 (i) Write the Truth table for F. Use the convention True=1 and False = 0.

(ii) Write the simplified expression for F in SOP form.

(iii) Write the simplified expression for F in POS form.

(iv) Draw logic circuit using minimum number of 2-input NAND gates.

2. Minimise the logic function

F (A,B,C,D)= ∑m(1, 2, 3, 8, 9, 10, 11,14)+d(7, 15)

Use Karnaugh map. Draw the logic circuit for the simplified function using NOR gates only.

1.Design a combinational circuit with three inputs and one output.

26 (a)The output is 1 when the binary value of the inputs is less than 3. The output is 0 otherwise.

(b) The output is 1 when the binary value of the inputs is an even number.

27 For F =A.B.C+B.C.D+A.B.C, write the truth table. Simplify using Karnaugh map and realize the function using NAND gates only.

1.Design a 32:1 multiplexer using two 16:1 multiplexers and a 2:1 multiplexer.

28 2.Implement the following function using a 3 line to 8 line decoder.

S (A,B,C) = ∑ m(1,2,4,7)

C (A,B,C) = ∑ m (3,5,6,7)

Solve the following equations for X

29 (i) 23.6_{10} =X2 (ii) 65.53510 = X_{16}

2.Simply the following Boolean function using Quine Mcclusky method

$F(A, B, C, D) = \Sigma m(0, 2, 3, 6, 7, 8, 10, 12, 13)$

1. What is a digital multiplexer? Illustrate its functional diagram. Write the scheme of a 4-input multiplexer using basic gates (AND/OR/NOT) and explain its operation.

30 2.What is meant by a priority encoder? Name the 7400 series TTL chip which is a priority encoder. Write its truth table. Illustrate how it can be used as a decimal-to-BCD encoder.

31 1.What is a Decoder? Compare a decoder and a demultiplexer with suitable block diagrams.

2.Draw the logic diagram of 4-bit Twisted Ring counter and explain its operation with the

	help of timing diagram.
32	1.Design a MOD-6 synchronous counter using J-K Flip-Flops. 2.What is a Shift Register? What are its various types? List out some applications of Shift Register.
33	1.Verify that the following operations are commutative but not associative (i) NAND (ii) NOR 2.Prove the following equations using the Boolean algebraic theorems: (i) A + *A* .B + A . *B* = A + B (ii) *A*BC + A *B* C + AB*C* + ABC = AB + BC + AC
34	Implement the following function using 4-to-1 multiplexer. Y(A,B,C)= ∑m(2,3,5,6)
35	Express the complement of the following functions in sum-of-minterms form: (a) *F*(*A*,*B* ,*C*, *D*) = g(2, 4, 7, 10, 12, 14) (b) *F* (*x*, *y*, *z*) = w(3, 5, 7)
36	Design a combinational circuit with three inputs, *x* , *y* , and *z* , and three outputs, *A*, *B* , and *C* . When the binary input is 0, 1, 2, or 3, the binary output is one greater than the input. When the binary input is 4, 5, 6, or 7, the binary output is two less than the input.
37	Design a four-bit binary synchronous counter with *D* flip-flops.
38	Perform the following additions using 2's complement (i) -20 to +26 (ii) +25 to -15 (i) Convert the decimal number 430 to Excess-3 code (ii) Convert the binary number 10110 to Gray code:
39	Design a 8 to 1 multiplexer by using the four variable function given by F(a,b,c,d)= ∑m(0,1,3,4,8,9,15)
40	Explain the operation of octal to binary encoder. Design a 4 : 1 multiplexer with strobe input using NAND gates.
41	Using *JK* flip-flops, (a) Design a counter with the following repeated binary sequence: 0, 1, 2, 3, 4, 5, 6.(b) Draw the logic diagram of the counter.
42	Implement the following two Boolean functions with a PLA: *F*1(*A*, *B*, *C*) = g(0, 1, 2, 4) *F*2(*A*, *B*, *C*) = g(0, 5, 6, 7)
43	Using 64 * 8 ROM chips with an enable input, construct a 512 * 8 ROM with eight chips and a decoder.
44	Tabulate the PLA programming table for the four Boolean functions listed below. Minimize the numbers of product terms. *A*(*x*, *y*, *z*) = ∑ (1, 3, 5, 6) *B*(*x*, *y*, *z*) = ∑ (0, 1, 6, 7) *C*(*x*, *y*, *z*) = ∑ (3, 5) *D*(*x*, *y*, *z*) = ∑ (1, 2, 4, 5, 7)
45	1.Convert the decimal number 82.67 to its binary, hexadecimal and octal equivalents. 2.Add 20 and (-15) using 2's complement. 3.Add 648 and 487 in BCD code.
46	1.Simplify the expressions using Boolean postulates **(i)** Y = (A + B)(*A* + C)(B + C) **(ii)** XY + *XZ* + X*Y* Z (XY + Z) 2.Minimize the logic function Y**(**A**,**B**,**C**,**D**)** = ∑m**(**0**,**1**,**2**,**3**,**5**,**7**,**8**,**9**,**11**,**14**)** . Use Karnaugh map. Draw logic circuit for the simplified function.
47	1. Simplify the given expression to its Sum of Products (SOP) form. Draw the logic circuit

for the simplified SOP function $Y = (A+B)(A+\overline{AB})C + \overline{A}(B+\overline{C}) + \overline{A}B + ABC$ 2.Design a 8 to 1 multiplexer by using the four variable function given by F**(**A**,**B**,**C**,**D**)** = ∑m**(**0**,**1**,**3**,**4**,**8**,**9**,**15**)** .

Tabulate the truth table for an 8 * 4 ROM that implements the Boolean functions

A(*x*, *y*, *z*) =∑ (0, 3, 4, 6)

48 *B*(*x*, *y*, *z*) = ∑ (0, 1, 4, 7)

C(*x*, *y*, *z*) = ∑_(1, 5)

D(*x*, *y*, *z*) = ∑ (0, 1, 3, 5, 7)

1. (a) Find the 16's complement of C3DF.

(b) Convert C3DF to binary.

49 (c) Find the 2's complement of the result in (b).

(d) Convert the answer in (c) to hexadecimal and compare with the answer in (a).

2.Represent the decimal number 6,248 in (a) BCD, (b) excess-3 code, (c) 2421 code, and (d) a 6311 code.

Implement the Boolean function *F* = XY + X'Y'+Y'Z

(a) With AND, OR, and inverter gates

50 (b) With OR and inverter gates

(c) With AND and inverter gates

(d) With NAND and inverter gates

(e) With NOR and inverter gates

Find all the prime implicants for the following Boolean functions, and determine which are essential:

(a) F (w, x, y, z) = ∑ (0, 2, 4, 5, 6, 7, 8, 10, 13, 15)

51 (b) F (A, B, C, D) = ∑ (0, 2, 3, 5, 7, 8, 10, 11, 14, 15)

(c) F(A, B, C, D) = ∑(2, 3, 4, 5, 6, 7, 9, 11, 12, 13)

(d) F(w, x, y, z) = ∑(1, 3, 6, 7, 8, 9, 12, 13, 14, 15)

(e) F(A, B, C, D) = ∑(0, 1, 2, 5, 7, 8, 9, 10, 13, 15)

(f) F(w, x, y, z) = ∑(0, 1, 2, 5, 7, 8, 10, 15)

Implement the following function using 8 to 1 multiplexer

52 $Y(A,B,C,D) = \sum (0,1,2,5,9,11,13,15)$

Prove the following identities

53 (i) $\overline{A}\,\overline{B}\,\overline{C} + \overline{A}\,B\,\overline{C} + A\overline{B}\,\overline{C} + A\,B\,\overline{C} = \overline{C}$

(ii) $A\,B + A\,B\,C + \overline{A}\,B + A\,\overline{B}\,C = B + A\,C$

1.With the help of a suitable diagram, explain how do you convert a JK flipflop to T type flipflop.

54 2.A number of 256 x 8 bit memory chips are available. To design a memory organization of 2 K x 8 memory. Identify the requirements of 256 x 8 memory chips and explain the details.

55 Design a BCD to excess 3 code converter using minimum number of NAND gates. Hint: use k map techniques.

56 1. Find the Boolean expression for logic circuit shown in Fig.1 below and reduce it using Boolean algebra.

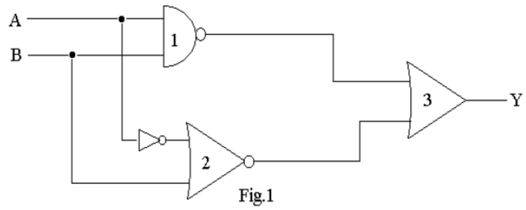


Fig.1

2. Design a mod-12 Synchronous up counter.

EC8391 - CONTROL SYSTEM ENGINEERING

Assignment Questions

1. Explain in detail about digital control Systems
2. Explain about Discrete time system representation
3. Illustrate and explain about mathematical modeling of sampling process
4. Discuss about Data reconstruction
5. Explain about Modeling discrete-time systems by pulse transfer function
6. Discuss about Mapping of s-plane to z-plane
7. Explain about Pulse transfer function
8. Write a note on Pulse transfer function of closed loop system
9. Discuss about Stability analysis of discrete time systems
10. Explain about Jury stability test
11. With a diagram explain Stability analysis using bi-linear transformation
12. With a diagram explain Deadbeat response design
13. Design the digital control systems with dead beat response
14. Practical issues with deadbeat response design
15. With a diagram explain Discrete state space model
16. Pole placement by state feedback
17. Derive and explain about Lyapunov stability theorem
18. State and explain feedback design
19. Explain about Set point tracking controller
20. Discuss about Reduced order observer
21. Discuss about the Output feedback design-Theory and Example
22. With example explain the Introduction to optimal control and its Basics
23. With a neat diagram explain Linear Quadratic Regulator (LQR) design
24. State Transition Matrix and its Properties
25. With a neat diagram explain System modeling-Cruise Control
26. Explain Bicycle Dynamics
27. Explain the operational Amplifier Circuits
28. Explain the computing Systems and Networks