MAHARAJA INSTITUTE OF TECHNOLOGY THANDAVAPURA

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VTU Question Papers

BE-Electronics & Communication

III to VII Semester

Jan/Feb-2023

2018 Scheme

Maharaja Institute of Technology Thandavapura
Just of NH-766,Mysore-ooty highway,Thandavapura(Vill & Post),Nanjangud Taluk,Mysore District-571302.

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CBCS SCHEME

USN | | | | | | | | | | | **18MAT31**

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Transform Calculus, Fourier Series and Numerical Techniques

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the Laplace transform of:
i) $(3t+4)^2 + 5^t$
ii) $e^{-t}\cos^2 3t$
iii) $\dfrac{\cos at - \cos bt}{t}$ **(10 Marks)**

b. Given $f(t) = \begin{cases} E, & 0 < t < a/2 \\ -E, & a/2 < t < a \end{cases}$ where $f(t+a) = f(t)$, show that $L[f(t)] = \dfrac{E}{S}\tanh\ (as/4)$. **(05 Marks)**

c. Employ Laplace transform to solve the equation: $y'' + 5y' + 6y = 5e^{2t}$, taking $y(0) = 2$, $y'(0) = 1$. **(05 Marks)**

OR

2 a. Find the Inverse Laplace transform of:
i) $\dfrac{(s+2)^2}{s^6}$ ii) $\dfrac{s+1}{s^2+6s+9}$ iii) $\dfrac{3s+2}{s^2-s-2}$ **(10 Marks)**

b. Express $f(t) = \begin{cases} 1, & 0 < t \le 1 \\ t, & 1 < t \le 2 \\ t^2, & t > 2 \end{cases}$ in terms Heaviside's unit step function and hence find its Laplace transform. **(05 Marks)**

c. Find the Laplace transform of $\dfrac{s}{(s^2+a^2)^2}$ using convolution theorem. **(05 Marks)**

Module-2

3 a. Find the Fourier series expansion of $f(x) = x - x^2$ in $-\pi \le x \le \pi$. Hence deduce that $\dfrac{x^2}{12} = \dfrac{1}{1^2} - \dfrac{1}{2^2} + \dfrac{1}{3^2} - \dfrac{1}{4^2} + \ldots\ldots$ **(07 Marks)**

b. Find the half-range cosine series of $f(x) = 2x-1$ in the interval $0 < x < 1$. **(06 Marks)**

c. Determine the constant term and the first cosine and sine terms of the Fourier series expansion of y from the following data:

x^o	0	45	90	135	180	225	270	315
y	2	3/2	1	1/2	0	1/2	1	3/2

(07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

4 a. Obtain the Fourier series of $f(x) = |x|$ in (*-l*, *l*). Hence show that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + ... = \frac{\pi^2}{8}$. **(07 Marks)**

b. Find the sine half range series of $f(x) = \begin{cases} \frac{1}{4} - x & \text{in} \quad 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \text{in} \quad \frac{1}{2} < x < 1 \end{cases}$ **(06 Marks)**

c. The following table gives the variations of a periodic current A over a certain period T:

t(sec)	0	T/6	T/3	T/2	2T/3	5T/6	T
A(amp)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a constant part of 0.75amp. in the current A, and obtain the amplitude of the first harmonic. **(07 Marks)**

Module-3

5 a. If $f(x) = \begin{cases} 1 - x^2, & |x| < 1 \\ 0, & |x| \geq 1 \end{cases}$ find the Fourier transform of f(x) and hence find the value of $\int_0^\infty \frac{x\cos x - \sin x}{x^3} dx$. **(07 Marks)**

b. Find the Fourier sine and cosine transform of $f(x) = e^{-\alpha x}$, $\alpha > 0$. **(06 Marks)**

c. Solve $u_{n+2} + 4u_{n+1} + 3u_n = 3^n$, given $u_0 = 0$, $u_1 = 1$ by using z-transform. **(07 Marks)**

OR

6 a. Find the Fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x\sin mx}{1+x^2} dx, \ m > 0$. **(07 Marks)**

b. Find the Z-transform of $\cos\left(\frac{n\pi}{2} + \frac{\pi}{4}\right)$.

c. Find the inverse Z-transform of $\frac{3z^2 + 2z}{(5z-1)(5z+2)}$. **(06 Marks)**

(07 Marks)

Module-4

7 a. Solve $\frac{dy}{dx} = x - y^2$, y(0) = 1 using Taylor's series method considering upto fourth degree terms and find the value of y(0.1). **(07 Marks)**

b. Using Runge-Kutta method of fourth order, find y(0.2) for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, y(0) = 1 taking h = 0.2. **(06 Marks)**

c. Apply Milne's method to compute y(1.4) correct to four decimal places given $\frac{dy}{dx} = x^2 + \frac{y}{2}$ and the data: y(1) = 2, y(1.1) = 2.2156, y(1.2) = 2.4649, y(1.3) = 2.7514. **(07 Marks)**

OR

8 a. Using modified Euler's method find y(20.2) given that $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with y(20) = 5 taking h = 0.2. **(07 Marks)**

b. Use Fourth order Runge-Kutta method to compute y(1.1) given that $\frac{dy}{dx} = xy^{1/3}$, y(1) = 1. **(06 Marks)**

c. If $\frac{dy}{dx} = 2e^x - y$, y(0) = 2, y(0.1) = 2.010, y(0.2) = 2.040 and y(0.3) = 2.090, find y(0.4) using Adams – Bashforth predictor-corrector method. **(07 Marks)**

Module-5

9 a. Given $\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} - 2xy = 1$, y(0) = 1, y′(0) = 0, evaluate y(0.1) using Runge-Kutta method of 4th order. **(07 Marks)**

b. Find the external of the functional $\int_{x_1}^{x_2}\left(y^{1^2} - y^2 + 2y\sec x\right)dx$. **(06 Marks)**

c. Derive Euler's equation in the standard form:
$\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y^1}\right) = 0$. **(07 Marks)**

OR

10 a. Apply Milne's method to compute y(0.8) given that $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ and the following table of initial values:

x	0	0.2	0.4	0.6
y	0	0.02	0.0795	0.1762
y′	0	0.1996	0.3937	0.5689

(07 Marks)

b. Find the external of the functional $\int_0^{\pi/2}(y^2 - y^{1^2} - 2y\sin x)\,dx$ under the end conditions y(0) = 0, y(π/2) = 0. **(06 Marks)**

c. Prove that the geodesics on a plane are straight lines. **(07 Marks)**

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CBCS SCHEME

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18EC32

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Network Theory

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the equivalent resistance between MN using star-delta transformation in the circuit in Fig. Q1 (a).

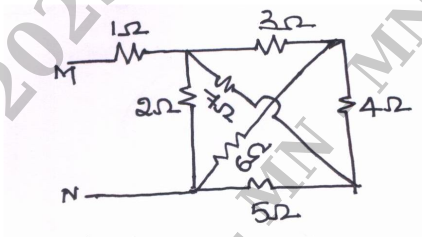

Fig. Q1 (a) **(06 Marks)**

b. Find I_o in the circuit in the Fig. Q1 (b) using node analysis.

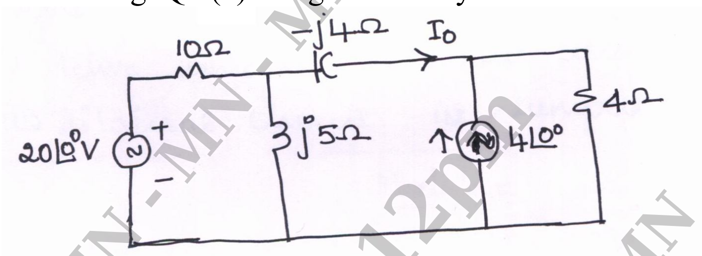

Fig. Q1 (b) **(08 Marks)**

c. Find the current I_x in the circuit shown in Fig. Q1 (c) using mesh analysis.

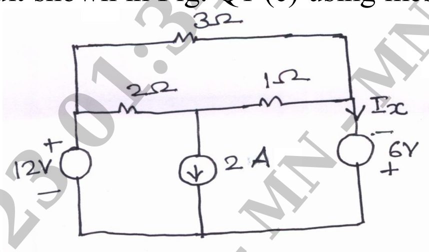

Fig. Q1 (c) **(06 Marks)**

OR

2 a. Find the current i_a in the circuit in Fig. Q2 (a) using mesh analysis.

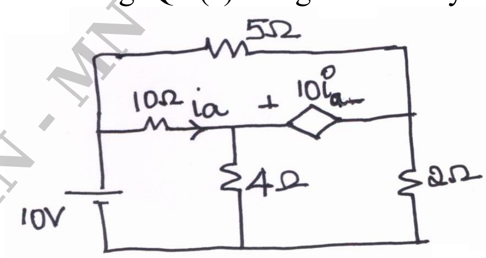

Fig. Q2 (a) **(08 Marks)**

b. Find the node voltage using node analysis in the Fig. Q2 (b).

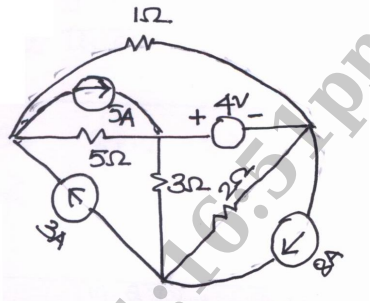

Fig. Q2 (b) **(08 Marks)**

c. Define the following terms with examples :
(i) Active elements (ii) Linear circuit
(iii) Bilateral circuit (iv) Lumped elements **(04 Marks)**

Module-2

3 a. In the circuit shown in Fig. Q3 (a), find the current through 10 Ω using Thevenin's theorem.

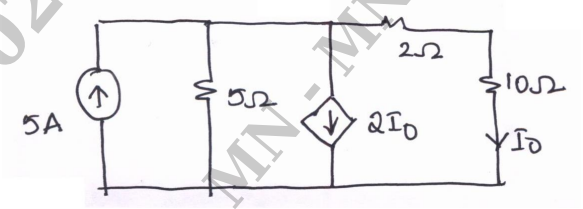

Fig. Q3 (a) **(08 Marks)**

b. Find the current through $(3 + j4)\Omega$ in the Fig. Q3 (b) using superposition theorem.

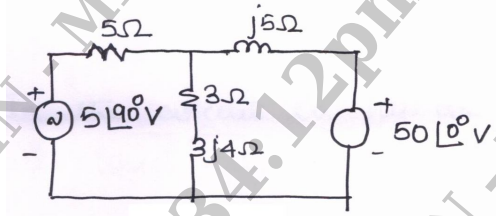

Fig. Q3 (b) **(08 Marks)**

c. For the circuit shown in Fig. Q3 (c), find the current flowing in $10 - j3$ impedance using Millman's theorem.

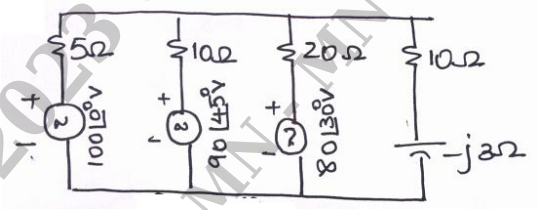

Fig. Q3 (c) **(04 Marks)**

OR

4 a. State superposition theorem. Find V_a in the circuit in Fig. Q4 (a) using superposition theorem.

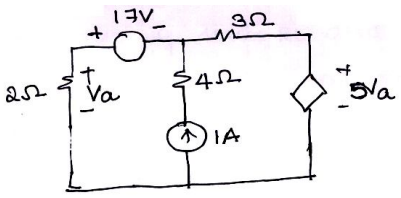

Fig. Q4 (a) **(10 Marks)**

b. State and find the condition for maximum power transfer in a 4C circuit, where both R_L and X_L are varying. **(10 Marks)**

Module-3

5 a. In the circuit in Fig. Q5 (a), the switch K is closed at t = 0, find $\frac{di_1(o+)}{dt}$ and $\frac{di_2(o+)}{dt}$.

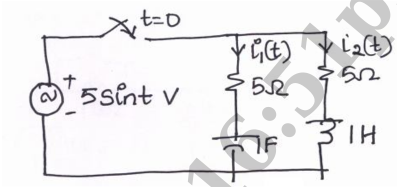

Fig. Q5 (a) **(07 Marks)**

b. In the circuit shown in Fig. Q5 (b), the switch K is moved from position 1 to position 2 at t = 0, the steady state has been reached before switching, calculate i(t), $\frac{di(t)}{dt}$ and $\frac{d^2i(t)}{dt^2}$ at t = 0+.

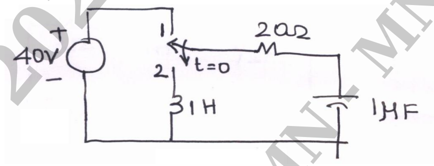

Fig. Q5 (b) **(08 Marks)**

c. What is time constant? Explain the time constant in case of series RL and RC circuits. **(05 Marks)**

OR

6 a. The Switch K is in the circuit in Fig. Q6 (a) is open for a long time. At t = 0 it is closed. Find $i_1(t)$, $i_2(t)$, $\frac{di_1(t)}{dt}$, $\frac{di_2(t)}{dt}$, $\frac{d^2i_1(t)}{dt^2}$, $\frac{d^2i_2(t)}{dt}$ at t = 0+.

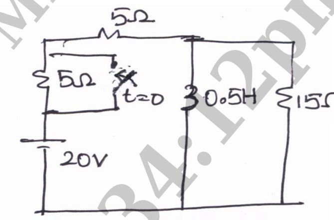

Fig. Q6 (a) **(10 Marks)**

b. In the circuit in Fig. Q6 (b), the switch across 10 Ω is closed at t = 0. Find the current $i_1(t)$, $i_2(t)$, $\frac{di_1(t)}{dt}$, $\frac{di_2(t)}{dt}$ at t = 0+.

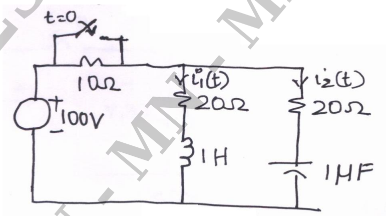

Fig. Q6 (b) **(10 Marks)**

Module-4

7 a. For a series RLC circuit, shown in Fig. Q7 (a), the initial condition are $i_L(0-)$ = 2A and $V_C(0-)$ = 2V. It is connected to a DC voltage of 5 V at t = 0. Find the current i(t) after switching action, using Laplace transforms.

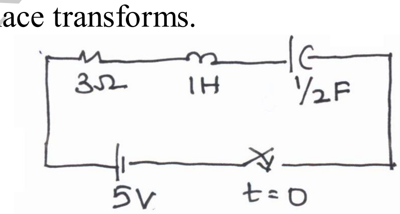

Fig. Q7 (a) **(10 Marks)**

b. Find the Laplace transform of the waveform in Fig. Q7 (b).

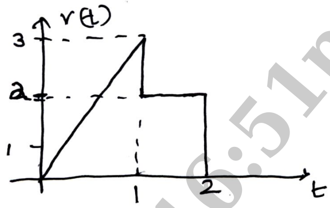

Fig. Q7 (b) **(05 Marks)**

c. Find the Laplace transform of unit step and unit ramp function. **(05 Marks)**

OR

8 a. State and prove initial value theorem and final value theorem. **(10 Marks)**

b. In the network Fig. Q8 (b) the switch is opened at t = 0. Find out the node voltage $V_1(t)$ and $V_2(t)$ after opening the switch.

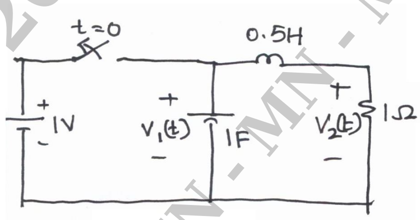

Fig. Q8 (b) **(10 Marks)**

Module-5

9 a. Obtain Z parameter for the circuit in Fig. Q9 (a).

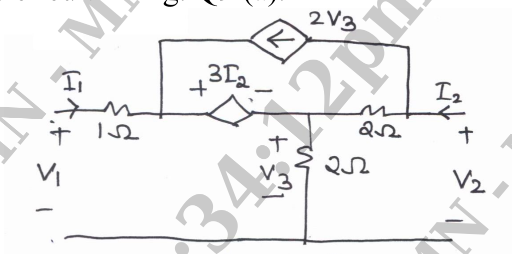

Fig. Q9 (a) **(10 Marks)**

b. Obtain an expression for resonant frequency in a parallel resonant circuit. **(06 Marks)**

c. Find the value of R_1 for which the circuit shown in Fig. Q9 (c) at resonance.

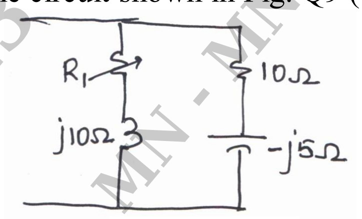

Fig. Q9 (c) **(04 Marks)**

OR

10 a. Define h-parameters and obtain the expression of h-parameters in terms of Y-parameters. **(10 Marks)**

b. The elements of RLC series circuit are R = 10 Ω, L = 0.04 H and C = 22 μF. When the circuit is excited by a variable frequency source 100 V, determine the voltage across inductance and capacitance at resonance. Also, determine the frequencies at which the voltage across L and C is maximum and the maximum voltage across L. **(10 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | |

18EC33

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Electronic Devices

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the classification of material based on conductivity and energy band diagram. **(06 Marks)**

b. Explain with neat diagram direct and indirect semiconductors. **(08 Marks)**

c. Consider a semiconductor bar with $\omega = 0.1$ mm, f = 10 μm and L = 5 mm. For $\beta = 10$ kg (1 kg = 10^{-5} ωb/cm^2) and a current of 1 mA, we have $V_{AB} = -2$ mV and V_{CD} = 100 mV. Find the type, concentration and mobility of the majority carrier. **(06 Marks)**

OR

2 a. What is Hall effect? Explain with suitable diagram and equations how does Hall effect works? **(10 Marks)**

b. Compare between intrinsic and extrinsic material. **(06 Marks)**

c. Calculate the conductivity effective mass of electrons in silicon. (For silicon, $m_l = 0.98\ m_0$ and $m_f = 0.19\ m_0$) **(04 Marks)**

Module-2

3 a. Explain the qualitative description of current flow at p-n junction under equilibrium and biased condition. **(10 Marks)**

b. Explain zener break down and avalanche break down under reverse bias condition. **(10 Marks)**

OR

4 a. Explain photodetector in brief. **(08 Marks)**

b. Explain the piecewise linear approximation of junction diode under ideal condition. **(08 Marks)**

c. A silicon solar cell has a short circuit current of 100 mA and open circuit voltage of 0.8 V under full solar illumination. The fill factor is 0.7. What is the maximum power delivered to a load by this cell? **(04 Marks)**

Module-3

5 a. Draw Ebers-Moll model for a PNP transistor and explain its significance. **(10 Marks)**

b. With neat diagram, explain step by step fabrication of double poly silicon self aligned npn BJT. **(10 Marks)**

OR

6 a. Explain effect of base narrowing with neat diagram. **(06 Marks)**

b. Discuss switching operation in common emitter transistor. **(07 Marks)**

c. Explain with neat diagram the various components of current flow and current directions for normal active mode of operation of PNP transistor. **(07 Marks)**

Module-4

7	a.	Explain with neat diagram construction and operation of n-JFET.	**(08 Marks)**
	b.	Explain two terminal MOS structure using energy band diagram.	**(08 Marks)**
	c.	Explain n-channel enhancement mode MOSFET with its circuit symbol.	**(04 Marks)**

OR

8	a.	Draw and explain small signal equivalent circuit of n-channel PNJFET.	**(07 Marks)**
	b.	Explain with neat diagram ideal C-V characteristics of MOS capacitor with P-type substrate.	**(07 Marks)**
	c.	Explain the effect of frequency on gate voltage of a MOS capacitor with P-type substrate.	**(06 Marks)**

Module-5

9	a.	Explain low pressure conical vapour deposition reactors.	**(07 Marks)**
	b.	Explain photolithography process.	**(07 Marks)**
	c.	What are the advantages of integration?	**(06 Marks)**

OR

10	a.	Explain method of ION implantation with schematic diagram.	**(10 Marks)**
	b.	Explain integration of other circuit elements with suitable diagram.	**(10 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | |

18EC34

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Digital System Design

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Convert the Boolean expression to canonical SOP form, $f = (xy + \bar{z})(y + x\bar{z})$. **(04 Marks)**

b. A switching circuit has four inputs A, B, C and D, and one output Y. The inputs A and B represent the bits of the number N_1, whereas the inputs C and D represent the bits of the number N_2. The output is to be high only if the product $N_1 \times N_2$ is less than 2. Draw the truth table and obtain the Maxterm expression. **(06 Marks)**

c. Simplify f(A, B, C, D, E) = Σ (5, 7, 9, 12, 13, 14, 15, 20, 21, 22, 23, 25, 29, 31) using a 5-varible K-map, and obtain the simplified SOP expression. **(10 Marks)**

OR

2 a. Convert the Boolean expression to canonical POS form $f = (a + b')(a + c)$. **(04 Marks)**

b. Use K-map to obtain the simplified POS expression for
f(A, B, C, D) = (A + B + $\overline{C}$) ($\overline{B}$ + $\overline{D}$) ($\overline{A}$ + C) (B + C). **(06 Marks)**

c. Simplify f(a, b, c, d) = Σ(9, 12, 13, 15) + dΣ (1, 4, 5, 7, 8, 11, 14), using QM technique out of several possible solutions, select solution which can be implemented using only one AND gate and one OR gate. **(10 Marks)**

Module-2

3 a. Draw the circuit of 2 × 4 decoder having enable input and active high outputs. Give its truth table. **(04 Marks)**

b. Construct a 16 × 1 multiplexer using only 4 × 1 multiplexers. **(06 Marks)**

c. Four chairs A, B, C and D are placed in a row. When the chair is empty, it is logic – 0, and when the chair is occupied, it is logic – 1. Design and implement a circuit using 8 × 1 multiplexer IC such that, whenever the adjacent chairs are occupied, the output should go high. **(10 Marks)**

OR

4 a. Implement a single – bit binary comparator circuit using basic gates, and give its truth table. **(04 Marks)**

b. Implement the multiple output function using a single 3 × 8 decoder IC and additional gates. f_1 (a, b, c) = Σ(1, 4, 5, 7), f_2 (a, b, c) = π (2, 3, 6, 7). **(06 Marks)**

c. Derive the expressions and draw the complete logic circuit of a 4-bit look-ahead carry adder. **(10 Marks)**

Module-3

5 a. Draw the circuit of gated SR latch using NAND gates, and give its truth table. **(04 Marks)**

b. Construct a 4-bit parallel in serial out shift register using negative edge triggered D flip-flops. **(06 Marks)**

c. With neat diagram and truth table, explain the working of master slave JK flip-flop. The inputs shown in Fig Q5(c), are applied to the master slave JK flip-flop, which is initially in 0-state. Sketch the Q_M and Q_S outputs.

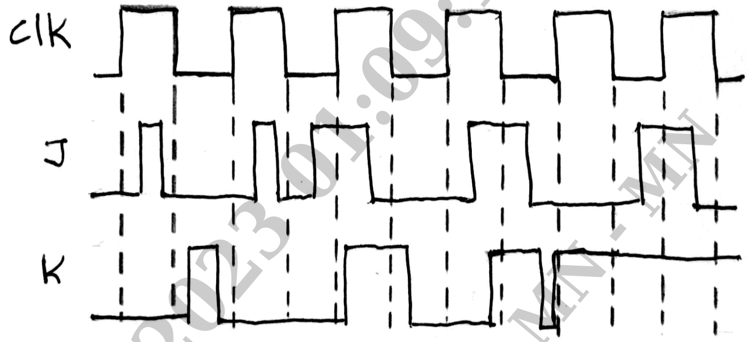

Fig Q5(c) **(10 Marks)**

OR

6 a. Give the comparison between combinational sequential circuits, with one example for each. **(04 Marks)**

b. Derive the characteristics equations of SR and JK flip-flops. **(06 Marks)**

c. Design a 4-bit binary ripple up-counter using positive edge triggered JK flip-flops. Neatly draw the timing diagrams, showing its complete count sequence. Mention the changes to be made in the above counter, using the same flip-flops so that it becomes a down-counter. **(10 Marks)**

Module-4

7 a. Draw the transition table and state diagram for the Moore circuit shown in Fig Q7(a).

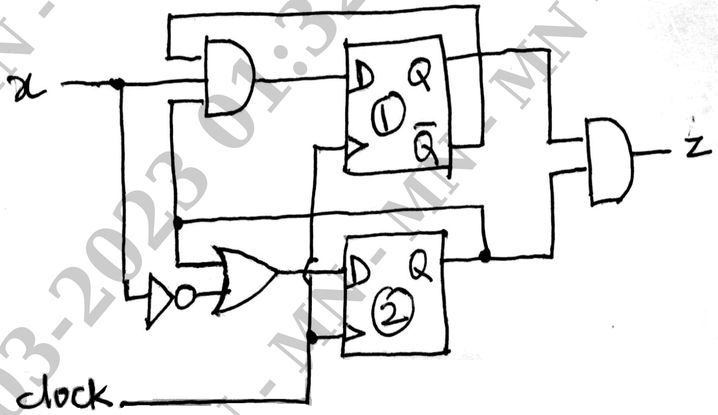

Fig Q7(a) **(08 Marks)**

b. Design a 3-bit synchronous counter having the repetitive count sequence of 0, 1, 2, 3, 5, 7 using JK flip flips. Check whether the counter is self correcting. **(12 Marks)**

OR

8 a. Design a mod – 5 synchronous binary counter, having the count sequence 0 to 4 and repeat, using D – flip-flops. **(08 Marks)**

b. Design a Mealy circuit for the state diagram shown in Fig Q8(b), Using JK flip-flops. Use the assignments: A = 00, B = 01 and C = 11.

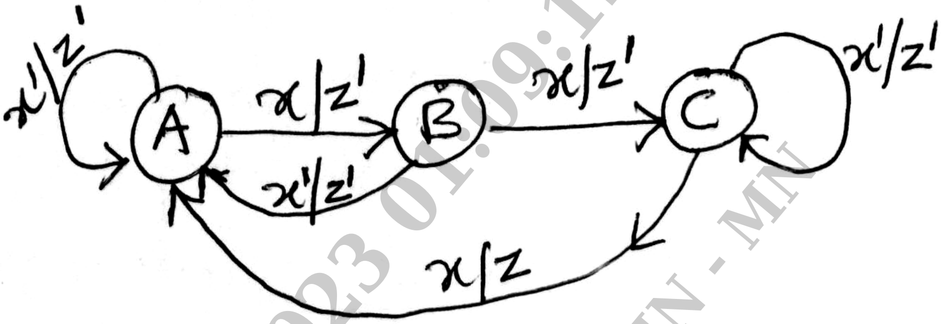

Fig Q8(b) **(12 Marks)**

Module-5

9 a. Construct a Mealy state diagram that will detect a serial input sequence of 10110 with overlap in a long data sequence. when the correct input pattern is detected, the output should go high. **(10 Marks)**

b. Design a Mealy state diagram for the sequential circuit that coverts a serial excess – 3 code to serial BCD code. The machine has to return to the beginning after four bits. The output should to high if the input is not a valid excess – 3 codes. **(10 Marks)**

OR

10 a. Draw the block diagram of a positive binary divider to divide an 8-bit dividend by a 4-bit divisor to obtain a 4-bit quotient and 4-bit remainder. Explain the operation briefly. **(10 Marks)**

b. Design a control circuit for a 4-bit serial adder using two shift register and a full adder. After receiving the start signal, the control circuit should give out four shift signals and then stop. When the addition is complete, the contents of one of the registers should be replaced by the sum. Draw the state diagram and transition table. Design and realize the circuit using D flip-flops. **(10 Marks)**

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CBCS SCHEME

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18EC35

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Computer Organization and Architecture

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. With a neat diagram, explain basic operational concepts of computer. **(10 Marks)**
b. Illustrate Instruction and Instruction sequencing with an example. **(10 Marks)**

OR

2 a. How to measure the performance of a computer? Explain. **(08 Marks)**
b. Explain the 3-address, 2-adress and 1-address instruction with an example. **(06 Marks)**
c. Explain system software functions in computer. **(06 Marks)**

Module-2

3 a. What is an addressing mode? Explain any four types of addressing modes with example. **(10 Marks)**
b. Define subroutine and parameter passing. Explain how to pass the parameter by value and by reference. **(10 Marks)**

OR

4 a. What are assembler directives? Explain any five assembler directives. **(10 Marks)**
b. Explain shift and rotate operations with example. **(10 Marks)**

Module-3

5 a. With relevant diagram, discuss, implementation of interrupt priority using individual interrupt request. **(06 Marks)**
b. Explain the following: i) Vectored interrupts ii) Simultaneous requests. **(08 Marks)**
c. Write a note on registers in DMA interface. **(06 Marks)**

OR

6 a. Define interrupt, point out and explain various ways of enabling and disabling interrupts. **(08 Marks)**
b. Write a program to read a line from the keyboard and display it. **(06 Marks)**
c. Define bus arbitration. Explain centralized arbitration mechanism in DMA with a neat diagram. **(06 Marks)**

Module-4

7 a. With a neat diagram, explain internal organization of 16 × 8 memory chip. **(10 Marks)**
b. With a neat diagram, explain the working principle of magnetic disk. **(06 Marks)**
c. What are the major functions of disk controller? **(04 Marks)**

OR

8 a. With a neat diagram, explain internal organization of a 2M × 8 dynamic memory chip. **(08 Marks)**

b. With a neat diagram explain a single-transistor dynamic memory cell. **(06 Marks)**

c. Discuss the concept of cache memory. **(06 Marks)**

Module-5

9 a. With a neat diagram, explain single bus organization of the data path inside a processor. **(08 Marks)**

b. Discuss the control unit organization of hard wired control. **(06 Marks)**

c. With a neat diagram, explain mircoprogrammed control unit design. **(06 Marks)**

OR

10 a. Explain three bus organization of the data path. **(08 Marks)**

b. Discuss the control sequence for execution of instruction ADD (R3), R1. **(06 Marks)**

c. Draw and explain organization of the control unit to show conditional branching in the micro program. **(06 Marks)**

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CBCS SCHEME

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18EC36

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Power Electronics and Instrumentation

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the static anode cathode characteristic of SCR. **(04 Marks)**

b. With the help of waveforms, explain dynamic turn on switching characteristics and turn-off mechanism of SCR. **(08 Marks)**

c. Write the applications of power electronics in various sectors. **(08 Marks)**

OR

2 a. Draw the circuit diagram of R.C. firing and explain its operation. **(06 Marks)**

b. With the help of circuit diagram and waveforms, explain Class-A commutation circuit. **(06 Marks)**

c. Design a UJT relaxation oscillator using UJT 2N2646, for triggering an SCR. The UJT has the following characteristics $\eta = 0.7$, $I_P = 50\ \mu A$, $V_V = 2V$, $I_V = 6$ mA, $V_{BB} = 20$ V, $R_{BB} = 7\ k\Omega$, $I_{EO} = 2$ mA. **(08 Marks)**

Module-2

3 a. With the help of circuit diagram and waveforms, explain the working of single phase full wave controlled rectifier. Consider M2 (midpoint) configuration and R-Load. **(08 Marks)**

b. Explain the effect of free wheeling diode in controlled rectifiers. **(04 Marks)**

c. A step down DC chopper has a resistive load of R = 15 Ω and input voltage $E_{dc} = 200$ V. When the chopper remains ON. Its voltage drop is 2.5 V. The chopper frequency is 1 kHz. If the duty cycle is 50%, determine: (i) Average output voltage (ii) RMS output voltage (iii) Chopper efficiency **(08 Marks)**

OR

4 a. Give the classifications of choppers according to the directions of output voltage and current. **(05 Marks)**

b. Explain the principle of operation of step up/down choppers with the help of circuit diagram. **(09 Marks)**

c. A single phase half wave controlled converter is operated from a 120 V, 50 Hz supply. Load resistance R = 10 Ω. If the average output voltage is 25% of the maximum possible average output voltage, determine: (i) Firing angle (ii) rms and average output currents (iii) Average and rms SCR currents **(06 Marks)**

Module-3

5 a. Define the following terms:
(i) Measurement (ii) Resolution (iii) Error (iv) Sensitivity **(04 Marks)**

b. Design a multi-range ammeter with range of 0-1A, 5A and 10A employing individual shunt in each D'Arsonval movement with an internal resistance of 500 Ω and a full scale deflection of 10 mA is available. **(08 Marks)**

c. With the help of necessary circuit diagram and waveforms, explain the operation of single phase half bridge inverter with R-Load. **(08 Marks)**

OR

6 a. Define the following:
   (i) Instrumental error
   (ii) Environmental errors
   (iii) Observational errors **(06 Marks)**

b. A voltmeter having a sensitivity of 1 KΩ/V is connected across an unknown resistance in series with a miliammeter reading 80 V on 150 scale. When the miliammeter reads 10 mA, calculate the
   (i) Apparent resistance of the unknown resistance
   (ii) Actual resistance of the unknown resistance
   (iii) Error due to the loading effect of the voltmeter. **(06 Marks)**

c. With the help of necessary circuit and waveforms, explain the operation of Buck converter. **(08 Marks)**

Module-4

7 a. With the help of neat block diagram, explain the working of dual slope integrating type digital voltmeter. **(08 Marks)**

b. An unbalanced Wheatstone bridge is given in Fig.Q7(b). Calculate the current through the galvanometer.

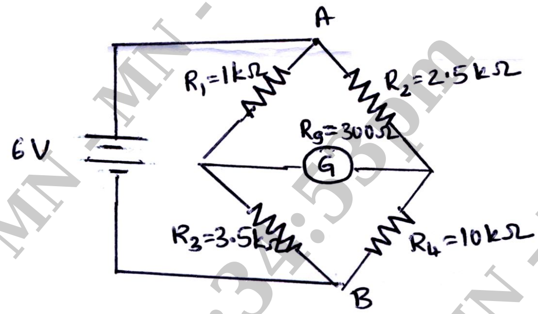

Fig.Q7(b) **(08 Marks)**

c. What is the principle of digital frequency measurement? Explain. **(04 Marks)**

OR

8 a. Explain successive approximation type digital voltmeter with the help of block diagram. **(08 Marks)**

b. Derive an expression for measuring unknown capacitance using capacitance comparison bridge. **(06 Marks)**

c. Obtain an expression for audio frequency using Wein's bridge **(06 Marks)**

Module-5

9 a. What are the parameters to be considered while selecting a transducer? **(04 Marks)**

b. Obtain an expression for the gauge factor of a strain gauge. **(08 Marks)**

c. Write the circuit of instrumentation amplifier and derive an expression for output voltage. **(08 Marks)**

OR

10 a. Explain the structure of PLC. **(07 Marks)**

b. Explain different type of thermistors. Also mention its advantages. **(06 Marks)**

c. With the help of diagram, explain the operation of linear variable differential transformer. **(07 Marks)**

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CBCS SCHEME

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18MAT41

Fourth Semester B.E. Degree Examination, Jan./Feb. 2023
Complex Analysis, Probability and Statistical Methods

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Show that $f(z) = \sin z$ is analytic and hence find $f'(z)$. **(06 Marks)**

b. Derive Cauchy Riemann equation in polar form. **(07 Marks)**

c. If f(z) is analytic, prove that $\left(\frac{\partial}{\partial x}|f(z)|\right)^2 + \left(\frac{\partial}{\partial y}|f(z)|\right)^2 = |f'(z)|^2$. **(07 Marks)**

OR

2 a. Find the analytic function whose imaginary part is $e^x(x\sin y + y\cos y)$. **(06 Marks)**

b. Show that $u = \sin x \cosh y + 2\cos x \sinh y + x^2 - y^2 + 4xy$ is harmonic. Also determine the analytic function f(z). **(07 Marks)**

c. Derive Cauchy Riemann equation in Cartesian form. **(07 Marks)**

Module-2

3 a. State and prove Cauchy's integral formula. **(06 Marks)**

b. Discuss the transformation $\omega = z^2$ **(07 Marks)**

c. Find the bilinear transformation which maps the points $z = \infty, i, 0$ into $\omega = -1, -i, 1$. Also find the fixed points of the transformation. **(07 Marks)**

OR

4 a. Evaluate $\int_C |z|^2 dz$ where C is the square with vertices (0, 0), (1, 0), (1, 1), (0, 1). **(06 Marks)**

b. Evaluate $\int_C \frac{e^{2z}}{(z+1)(z-2)}$ where C is the circle $|z| = 3$. **(07 Marks)**

c. Find the bilinear transformation which map the points $Z_1 = i$, $Z_2 = 1$, $Z_3 = -1$ onto the points $\omega_1 = 1$, $\omega_2 = 0$, $\omega_3 = \infty$. **(07 Marks)**

Module-3

5 a. The probability distribution of a random variable X is given by the following table:

x	0	1	2	3	4	5	6	7
P(x)	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2+K$

(i) Find K

(ii) Evaluate $P(X < 6)$ and $P(3 < x \le 6)$ **(06 Marks)**

b. The number of telephone lines busy at an instant of time is a binomial variate with probability 0.1 that a line is busy. If 10 lines are chosen at random, what is the probability that, (i) no line is busy (ii) all lines are busy (iii) at least one line is busy (iv) Atmost 2 lines are busy. **(07 Marks)**

c. In a certain town the duration of a shower is exponentially distributed with mean 5 minutes. What is the probability that a shower will last for :

- (i) 10 minutes or more
- (ii) Less than 10 minutes.
- (iii) Between 10 and 12 minutes **(07 Marks)**

OR

6 a. The probability density function of a random variable is,

$$P(x) = \begin{cases} Kx^2, & -3 \le x \le 3 \\ 0, & \text{Otherwise} \end{cases}$$

Find (i) K (ii) $P(1 \le x \le 2)$ (iii) $P(x \le 2)$ **(06 Marks)**

b. The probability that a news reader commits no mistake in reading the news is $\frac{1}{e^3}$. Find the probability that on a particular news broadcast he commits (i) Only 2 mistakes (ii) more than 3 mistakes (iii) atmost 3 mistakes, assuming that mistakes follow Poisson distribution. **(07 Marks)**

c. The marks of 1000 students in an examination follows a normal distribution with mean 70 and standard deviation 5. Find the number of students whose marks will be, (i) less than 65, (ii) more than 75 (iii) between 65 and 75. (Given $\phi(1) = 0.3413$) **(07 Marks)**

Module-4

7 a. The ranking of 10 students in two subjects, Field theory (A) and Network Analysis (B) are given below:

Roll No. of the students	1	2	3	4	5	6	7	8	9	10
A	3	5	8	4	7	10	2	1	6	9
B	6	4	9	8	1	2	3	10	5	7

Calculate the Rank correlation coefficient. **(06 Marks)**

b. Fit a parabola $y = a + bx + cx^2$ for the data.

x	0	1	2	3	4
y	1	1.8	1.3	2.5	2.3

(07 Marks)

c. In a partially destroyed Laboratory record of an analysis. The lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y - 107 = 0$. Calculate $\bar{x}, \bar{y}$ and coefficient of correlation between x and y. **(07 Marks)**

OR

8 a. If θ is the angle between the two regression lines, show that

$$\tan\theta = \frac{1 - r^2}{r} \cdot \frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2}$$

(06 Marks)

b. Fit a straight line in the least square sense for the following data:

x	50	70	100	120
y	12	15	21	25

(07 Marks)

c. Find the coefficient of correlation for the data.

x	10	14	18	22	26	30
y	18	12	24	6	30	36

(07 Marks)

Module-5

9 a. Determine (i) Marginal distribution (ii) Covariance between the discrete random variables X and Y along with the joint probability distribution.

X \ Y	1	3	9
2	$1/8$	$1/24$	$1/12$
4	$1/4$	$1/4$	0
6	$1/8$	$1/24$	$1/12$

(06 Marks)

b. In 324 throws of a six faced 'die', an odd number turned up 181 times. Is it possible to think that the 'die' is an unbiased one? **(07 Marks)**

c. A random sample of 10 boys had the following:
I.Q : 70, 120, 110, 101, 88, 83, 95, 98, 107, 100
Does the data support the assumption of a population mean I.Q of 100 at 5% level of significance?
$\left(\text{Note}: t_{0.05} = 2.262 \text{ for g d.f}\right)$ **(07 Marks)**

OR

10 a. Explain the terms : (i) Null hypothesis (ii) Confidence intervals (iii) Type I and II errors **(06 Marks)**

b. The joint probability of the random variable X and Y as follows :

X \ Y	−4	2	7
1	$1/8$	$1/4$	$1/8$
5	$1/4$	$1/8$	$1/8$

Compute :
(i) E(X) and E(Y)
(ii) E(XY)
(iii) σ_X and σ_Y
(iv) COV(X, Y) **(07 Marks)**

c. Fit a Poisson distribution for the data and test the goodness of fit given that $\chi^2_{0.05} = 7.815$ for 3 d.f

x	0	1	2	3	4
f	122	60	15	2	1

(07 Marks)

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CBCS SCHEME

USN | | | | | | | | | | **18EC42**

Fourth Semester B.E. Degree Examination, Jan./Feb. 2023
Analog Circuits

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Explain the working of classical discrete circuit Bias – voltage divider bias. **(10 Marks)**

b. Design a collector – to – base bias circuit for the specified conditions. Given : $V_{CC} = 15V$, $V_{CE} = 5V$, $I_C = 5mA$, $\beta = 100$. **(10 Marks)**

OR

2 a. Draw and explain the MOSFET biasing circuit using Fixed V_G. **(10 Marks)**

b. Derive the expression for g_m and A_V for the MOSFET amplifier circuit. **(10 Marks)**

Module-2

3 a. Write a note on three basic configuration of a MOSFET amplifier. Derive expression for characterizing parameters of MOSFET amplifier. **(10 Marks)**

b. Draw the high frequency equivalent circuit of a MOSFET and explain the significance of the different elements of the circuit. **(10 Marks)**

OR

4 a. Explain the working of RC – phase shift oscillator using FET. **(10 Marks)**

b. In Hartley oscillator $L_1 = 20\mu H$, $L_2 = 2mH$ and C variable. Find the range of C, if frequency is to be varied from 1 MHz to 2.5 MHz. Neglect the mutual inductance. **(10 Marks)**

Module-3

5 a. Draw the block diagram of current series feedback amplifier and derive an expression for input resistance, voltage gain, and output resistance. **(10 Marks)**

b. How power amplifiers are classified? Explain them briefly. **(10 Marks)**

OR

6 a. Explain the working of class B push pull amplifier with relevant waveforms. Show that maximum conversion efficiency is 78.5%. **(10 Marks)**

b. Explain series – shunt (voltage series) feedback amplifier. Determine input and output resistance of the amplifier. **(10 Marks)**

Module-4

7 a. Explain the working of inverting schmit trigger. Derive the equation for the trigger points. **(10 Marks)**

b. Derive an expression for the output of an inverting summing amplifier with 3 inputs and hence prove the circuit can act averaging amplifier. **(10 Marks)**

OR

8 a. Explain the working of instrumentation amplifier. Mention its applications. **(10 Marks)**

b. Explain the working of practical non-inverting amplifier. **(10 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-5

9 a. Explain Successive – Approximation type – ADC with neat block diagram. **(10 Marks)**

b. Explain the working of precision full wave rectifier with relevant circuit and waveforms. **(10 Marks)**

OR

10 a. Explain the working of a monostable multifier with relevant circuit and wave forms. Mention few applications of this circuit. **(10 Marks)**

b. Design a second order low-pass Butterworth filter having high cut-off frequency of 1 KHz. Draw its frequency response. **(10 Marks)**

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CBCS SCHEME

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18EC43

Fourth Semester B.E. Degree Examination, Jan./Feb. 2023
Control Systems

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define Control System. Write the differences between open loop control system and closed loop control system. **(05 Marks)**

b. For the mechanical system shown in Fig.Q.1(b). Write: i) The mechanical network ii) The equations of performance iii) The electrical network based on Force-Current analogy. **(08 Marks)**

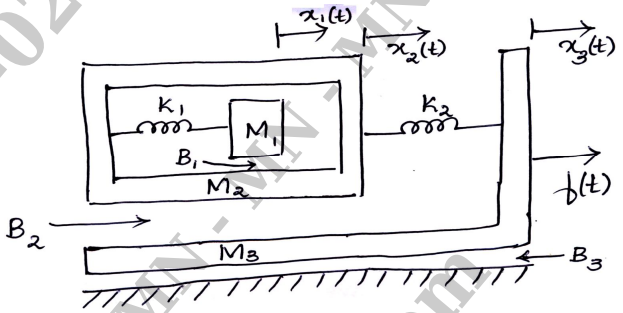

Fig.Q.1(b)

c. Find the transfer function $\frac{X_1(S)}{F(S)}$ for the system shown in Fig.Q.1(c). **(07 Marks)**

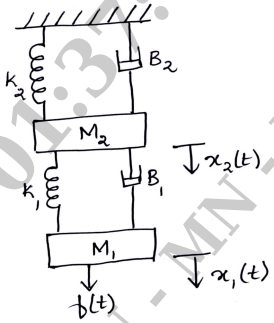

Fig.Q.1(c)

OR

2 a. What are the effects of feedback in control system? **(05 Marks)**

b. For the rotational system shown in Fig.Q.2(b) draw the mechanical network. Obtain the equations of performance and find the transfer function $\frac{\theta_1(S)}{T(S)}$. **(07 Marks)**

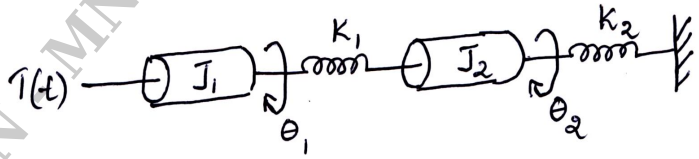

Fig.Q.2(b)

c. For the mechanical system shown in Fig.Q.2(c). Find the analogous electrical network based on Force-Voltage analogy. **(08 Marks)**

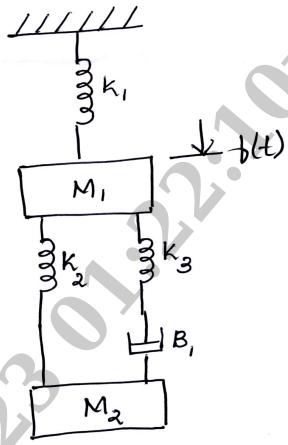

Fig.Q.2(c)

Module-2

3 a. Obtain the transfer function of the system shown in Fig.Q.3(a) using block diagram reduction technique.

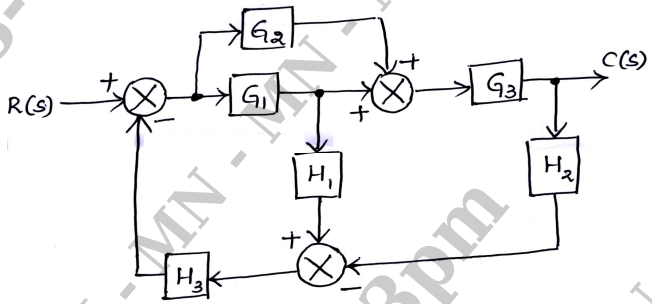

Fig.Q.3(a)

(10 Marks)

b. Find $\frac{C(S)}{R(S)}$ for the signal flow graph shown in Fig.Q.3(b) using Mason's Gain formula.

(10 Marks)

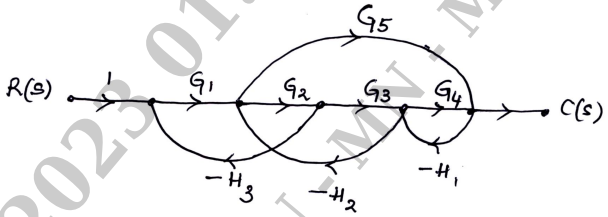

Fig.Q.3(b)

OR

4 a. Draw the corresponding SFG for the block diagram shown in Fig.Q.4(a) and obtain the transfer function using Mason's Gain formula. **(10 Marks)**

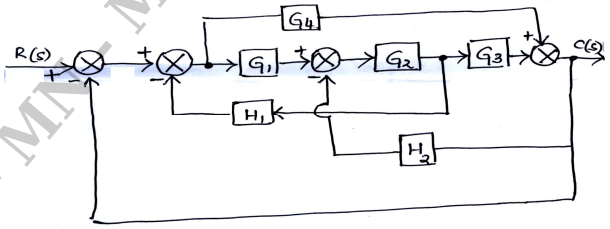

Fig.Q.4(a)

b. Find $\frac{C}{R}$ using block diagram reduction technique. **(10 Marks)**

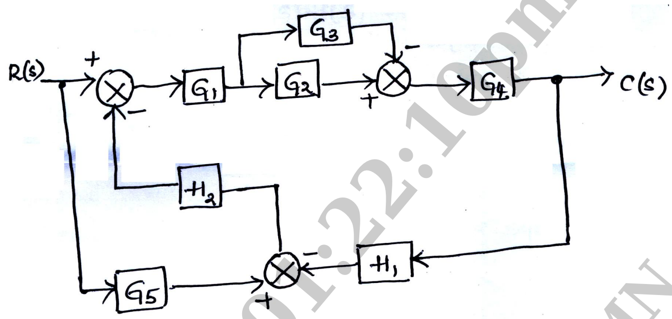

Fig.Q.4(b)

Module-3

5 a. Explain the following test signals with the help of graph and mathematical expression:
i) Step signal ii) Ramp signal iii) Parabolic signal. **(06 Marks)**

b. Derive the expression for the underdamped response of a second order feedback control system for step input. **(08 Marks)**

c. Derive the expression for rise time (T_r) of an underdamped second order system. **(06 Marks)**

OR

6 a. A unity feedback control system is characterized by an open loop transfer function $G(S)H(S) = \frac{K}{S(S+10)}$. Determine the system gain K, so that the system will have a damping ratio of 0.5. For this value of K, find the rise time, peak time, settling time and peak overshoot. Assume the system is subjected to a step of 1V. **(10 Marks)**

b. Find the position, velocity and acceleration error constants for a control system having open loop transfer function $G(S) = \frac{50}{S(S+5)}$. Also calculate, percentage overshoot for a unit step input, settling time for a unit step input and steady state error for an input defined by the polynomial $r(t) = 2 + 4t + 6t^2, t \geq 0$. **(10 Marks)**

Module-4

7 a. For the characteristic equation given by $S^4 + 25S^3 + 15S^2 + 20S + K = 0$. Determine: i) The range of value of K, so that the system is asymptotically stable ii) The value of K so that the system is marginally stable and find the frequencies of sustained oscillations. **(06 Marks)**

b. The open loop transfer function of a control system is given by
$G(S).H(S) = \frac{K}{S(S+1)(S+2)}$. Sketch the complete Root Locus. **(14 Marks)**

OR

8 a. Define:
i) Gain Margin
ii) Phase Margin
iii) Phase Cross Over Frequency. **(06 Marks)**

b. Plot the Bode diagram for the open loop transfer function of a unity feed back system given by $G(S) = \frac{100(0.1S+1)}{S(S+1)^2(0.01S+1)}$. Find Gain Margin and phase Margin. Also comment on the closed loop stability of the system. **(14 Marks)**

Module-5

9 a. Explain the steps involved in using Nyquist criterion. **(06 Marks)**

b. Represent the electrical circuit shown in Fig.Q.9(b) by a state model. **(10 Marks)**

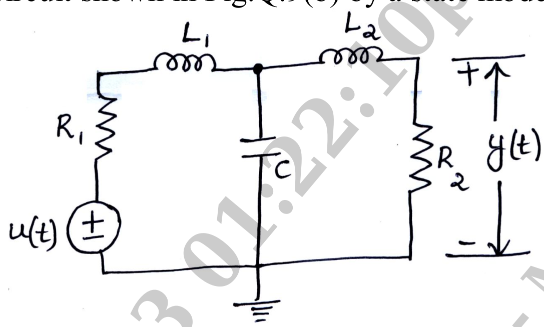

Fig.Q.9(b)

c. Write a short note on advantages of state variable approach. **(04 Marks)**

OR

10 a. Find the state transition matrix for

$$A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}.$$ **(10 Marks)**

b. Obtain state model for the given mechanical system shown in Fig.Q.10(b). **(10 Marks)**

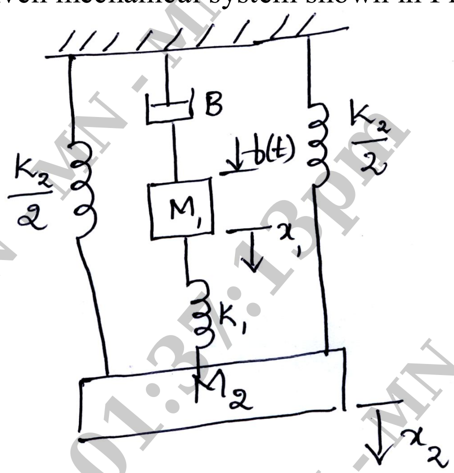

Fig.Q.10(b)

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CBCS SCHEME

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18EC44

Fourth Semester B.E. Degree Examination, Jan./Feb. 2023
Engineering Statistics & Linear Algebra

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define cdf, pdf and pmf with example. **(06 Marks)**

b. The following is the pdf for random variable U,

$$f_U(u) = \begin{cases} C\exp\left(-\frac{u}{2}\right), & 0 \le u < 1 \\ 0, & \text{otherwise} \end{cases}$$

Find the value that C must have and evaluate $F_U(0.5)$. **(06 Marks)**

c. Given the data in the following table :

k	x_k	$P(x_k)$
1	2.1	0.21
2	3.2	0.18
3	4.8	0.20
4	5.4	0.22
5	6.9	0.19

(i) Plot pdf and cdf of the discrete random variable X.

(ii) Write expression for $f_X(x)$ and $F_X(x)$ using unit delta functions and unit step function. **(08 Marks)**

OR

2 a. Define Expectation, Variance and characteristic functions. **(04 Marks)**

b. Explain the probability models for Gaussian and exponential random variables. **(08 Marks)**

c. The random variable X is uniformly distributed between 0 and 4. The random variable Y is obtained from X using $y = (x-2)^2$. Evaluate CDF and PDF for Y. **(08 Marks)**

Module-2

3 a. Obtain the expressions for different bivariate expectations. **(06 Marks)**

b. It is given that E[X] = 2.0 and that $E[X^2] = 6$. Find the standard deviation of X. Also if $Y = 6X^2+2X-13$, find μ_Y. **(07 Marks)**

c. The mean and variance of random variable X are -2 and 3 ; the mean and variance of Y are 3 & 5. The covariance $COV[XY] = -0.8$. Find correlation co-efficient ρ_{XY} and correlation E[XY]. **(07 Marks)**

OR

4 a. The joint pdf of a bivariate random variable X and Y is given by,

$$F_{XY}(x,y) = \begin{cases} k(x+y), & 0 < x, y < z \\ 0, & \text{otherwise} \end{cases}$$ where k is constant.

(i) Find the value of k.

(ii) Find the marginal pdf's of X and Y.

(iii) Are X and Y independent? **(06 Marks)**

b. The random variable U has a mean of 0.3 and a variance of 1.5

(i) Find the mean and variance of Y if $Y = \frac{1}{53}\sum_{i=1}^{53} u_i$

(ii) Find the mean and variance of Z if $Z = \sum_{i=1}^{53} u_i$

In these two sums, the u_i's are IID. **(04 Marks)**

c. Explain briefly Chi square random variable. **(10 Marks)**

Module-3

5 a. Explain Random process, stationarity and wide sense stationarity random process. **(06 Marks)**

b. X(t) and Y(t) are independent, jointly wide sense stationarily random processes given by $X(t) = A\cos(\omega_1 t + \theta_1)$ and $Y(t) = B\cos(\omega_2 t + \theta_2)$. If W(t) = X(t).Y(t), find Auto Correlation function $R_W(Z)$. **(06 Marks)**

c. Define Auto Correlation Function (ACF) of a random process. List and prove the properties of Auto Correlation. **(08 Marks)**

OR

6 a. Explain Wiener-Kenchin relations. **(06 Marks)**

b. A PSD is shown in Fig. Q6 (b) where constants are a = 55, b = 5, $\omega_0 = 1000$, $\omega_1 = 100$. Solve the values for $E[X^2(t)]$, σ_X^2 and μ_X.

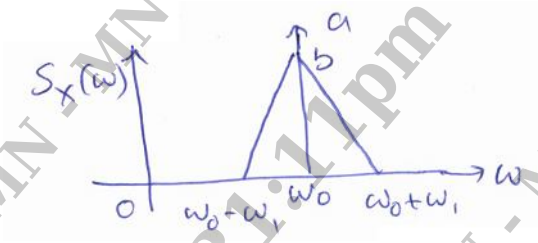

Fig. Q6 (b) **(06 Marks)**

c. Assume that the following table is obtained from a windowed sample function obtained from a random Ergodic process. Solve for the ACF for Z = 0, 2 and 4 ms.

x(t)	1.5	2.1	1.0	2.2	−1.6	− 2.0	− 2.5	2.5	1.6	1.8
k	0	1	2	3	4	5	6	7	8	9

(08 Marks)

Module-4

7 a. Define vector space and axioms of vector spaces. **(06 Marks)**

b. Let W be the subspace of R^5 spanned by,

$x_1 = (1\ \ 2\ \ -1\ \ 3\ \ 4)$, $x_2 = (2\ \ 4\ \ -2\ \ 6\ \ 8)$, $x_3 = (1\ \ 3\ \ 2\ \ 2\ \ 6)$

$x_4 = (1\ \ 4\ \ 5\ \ 1\ \ 8)$, $x_5 = (2\ \ 7\ \ 3\ \ 3\ \ 9)$

Find the basis and dimension of W. **(06 Marks)**

c. If vectors $u = \begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix}$, $v = \begin{bmatrix} 2 \\ -2 \\ 1 \end{bmatrix}$, $w = \begin{bmatrix} 2 \\ 1 \\ -2 \end{bmatrix}$

Then show that the vectors U, V and W form orthogonal pairs. Also find the length of vectors U, V and W. **(08 Marks)**

OR

8 a. Determine whether the vectors $(1 \quad 4 \quad 9)$, $(3 \quad 1 \quad 9)$ and $(9 \quad 3 \quad 12)$ are linearly dependent or independent. **(06 Marks)**

b. List and explain four fundamental subspaces. **(06 Marks)**

c. Apply Gram-Schmidt process to vectors to obtain an orthonormal basis for $v_3(R)$ with the standard inner product. $v_1 = (2 \quad 2 \quad 1)$, $v_2 = (1 \quad 3 \quad 1)$, $v_3 = (1 \quad 2 \quad 2)$ **(08 Marks)**

Module-5

9 a. Reduce the matrix A to U. Find det(A). $A = \begin{bmatrix} 2 & 5 & 3 \\ 1 & 2 & 4 \\ -1 & 3 & 6 \end{bmatrix}$. **(04 Marks)**

b. Find Eigen values and Eigen vectors of matrix, $A = \begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$. **(10 Marks)**

c. What is positive definite matrix? Mention the methods of testing positive definiteness. Check the following matrix for positive definiteness.

$S_1 = \begin{bmatrix} 5 & 6 \\ 6 & 7 \end{bmatrix}$. **(06 Marks)**

OR

10 a. Compute A^TA and AA^T. Find eigen values and unit Eigen vectors for $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \\ -1 & 1 \end{bmatrix}$. Multiply the three matrices. $U\sum V^T$ to recover A. **(12 Marks)**

b. Expand the determinant $A = \begin{bmatrix} 3 & 1 & 4 & 2 \\ 1 & 5 & 2 & 6 \\ 2 & 3 & 7 & 1 \\ 4 & 1 & 2 & 3 \end{bmatrix}$ **(08 Marks)**

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CBCS SCHEME

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18EC45

Fourth Semester B.E. Degree Examination, Jan./Feb. 2023
Signals and Systems

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Determine even and odd components of a signals shown in Fig Q1(a)

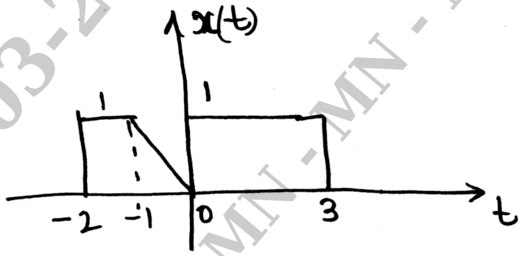

Fig Q1(a) **(06 Marks)**

b. Sketch the signals x(n), y_1(n) and y_2(n), where x(n) = (n – 6) [u(n) – u(n – 6)], $y_1(n) = x(2n)$ $y_2(n) = x(2n - 3)$. **(08 Marks)**

c. Determine the energy of the signals $y(t) = \frac{d}{dt}x(t)$, where x(t) = Sin 10πt [u(t) – u(t – 0.2)]. **(06 Marks)**

OR

2 a. Verify the following signals are periodic or non-periodic, if periodic find the fundamental period of a signals

i) $x(t) = \cos 20\pi t \cdot \sin \sqrt{2}\,\pi t$ ii) $x(n) = \cos 100\pi n + \sin 5\pi n$. **(06 Marks)**

b. Sketch the signals $y_1(t) = x(2t - 5)$ and $y_2(t) = x(2t + 5)$. Where x(t) shown in Fig Q2(b)

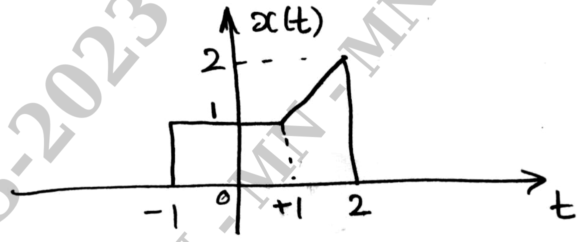

Fig Q2(b) **(08 Marks)**

c. Explain x(t) interms and elementary signals as shown in Fig Q2(c)

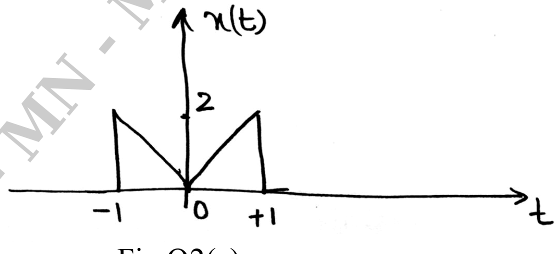

Fig Q2(c) **(06 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-2

3 a. Verify the following systems are Linear, time invariant causal stable.
i) y(t) = tx (t) ii) y(n) = x(-n) **(08 Marks)**

b. Determine the convolution integral of $e^{-2t}u(t) * e^{-t}u(t)$. **(06 Marks)**

c. Find response of a system whose input and impulse response given by

$$x(t) = \begin{cases} 1, & 0 \le t \le 4 \\ 0 & \text{otherwise} \end{cases} \text{ and } y(t) = \begin{cases} 1 & -2 \le t \le 1 \\ 0 & \text{otherwise} \end{cases}.$$ **(06 Marks)**

OR

4 a. Evaluate the convolution sum of $(2)^n u(-n) * \left(\frac{1}{3}\right)^n u(n)$ **(08 Marks)**

b. Verify the following systems are linear, time invariant and stable
i) $y(n) = e^{x(n)}$ ii) $y(t) = e^{tx(t)}$ **(06 Marks)**

c. Determine the convolution sum using graphical method where
$x(n) = [\underset{\uparrow}{1}, 1, 1, 1]$ $h(n) = [\underset{\uparrow}{2}, 2, -2, -2]$ **(06 Marks)**

Module-3

5 a. State and prove associate property and convolution integral. **(06 Marks)**

b. Verify the following LTI systems are stable, causal and memory less.
i) $h(t) = e^{-t}u(t)$ ii) $h(n) = (n-2)[u(n+1) - u(n-2)]$ **(06 Marks)**

c. Determine the Fourier series coefficient of the signal x(t) = Cos(10πt) Sin (20π(t) ; sketch magnitude and phase spectrum. **(08 Marks)**

OR

6 a. Determine the step response of the following signals
i) $h(n) = \left(\frac{1}{2}\right)^{|n|}$ ii) $h(t) = t[u(t) - u(t-1)]$ **(08 Marks)**

b. Determine the Fourier series coefficient of the signals x(t) = 10Cos10πt + 2 Sin 100πt, Sketch magnitude and phase spectrum. **(06 Marks)**

c. Determine the impulse response of the system given by the input and output relationship below. Also determine whether the system is stable or unstable. Assume h(n) is causal
$y(n) = x(n) + \frac{1}{2}y(n-1)$ **(06 Marks)**

Module-4

7 a. Determine the Fourier transform of the signal

$$x(t) = \begin{cases} 1, & 0 \le t \le 4 \\ 0 & \text{otherwise} \end{cases}$$ Sketch magnitude and phase spectrum. **(08 Marks)**

b. State and prove Time scaling property of Fourier transform. **(05 Marks)**

c. Determine the DTFT of the signal $x(n) = \left(\frac{1}{2}\right)^n u(n)$. sketch magnitude and phase spectrum. **(07 Marks)**

OR

8 a. State and prove Parsevals property and Fourier transform. **(05 Marks)**

b. Determine the DTFT and the signal $x(n) = [\underset{\uparrow}{1}, 1, 1, 1, 1]$ sketch magnitude and phase spectrum. **(08 Marks)**

c. Determine the Fourier transform of the signal x(t) = $e^{-|t|}$. Sketch magnitude and phase spectrum. **(07 Marks)**

Module-5

9 a. Determine the z-transform of the signal $x(n) = -2^n u(-n-1) + \left(\frac{1}{3}\right)^n u(n)$. also sketch RoC. **(08 Marks)**

b. Find the inverse z-transform of $X(z) = \frac{1}{z^2 - 5z + 6}$ for all possible RoC. **(08 Marks)**

c. State any four properties of RoC. **(04 Marks)**

OR

10 a. Determine the impulse response of the system given below

$y(n) - \frac{5}{6}y(n-1) + \frac{1}{6}y(n-2) = x(n) - 2x(n-1)$. Determine h(n) for the following condition

i) Stable ii) Causal. **(12 Marks)**

b. Determine inverse z-transform using long division method or power series.

$X(z) = \frac{1}{1 - \frac{1}{2}z^{-1}}$ $(z) > \frac{1}{2}$ ii) $X(z) = \frac{1}{1 - \frac{1}{2}z^{-1}}$ $(z) < \frac{1}{2}$. **(08 Marks)**

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CBCS SCHEME

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18EC46

Fourth Semester B.E. Degree Examination, Jan./Feb. 2023
Microcontroller

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Differentiate between microcontrollers and microprocessor (any five). **(05 Marks)**

b. Explain the following pins of 8051 microcontroller i) $\overline{EA}$ ii) ALE iii) $\overline{PSEN}$ iv) XTAL1 and XTAL2 v) $\overline{RD}$. **(05 Marks)**

c. With a neat block diagram, explain the architecture of 8051 microcontroller briefly. **(10 Marks)**

OR

2 a. Explain in brief with respect to 8051 microcontroller:
i) Program status word ii) Dual function of port 3 pins. **(04 Marks)**

b. Show neat schematic to interface 8KBROM (External) and 8KB external Data RAM to 8051 microcontroller. **(06 Marks)**

c. Write circuit diagram of port 1, Explain input, output operations in 8051 using port 1. **(10 Marks)**

Module-2

3 a. Define addressing mode, explain the addressing modes of 8051 with examples (any 4). **(10 Marks)**

b. Explain the following instructions of 8051 with an example for each instruction:
i) SUBBA, addr ii) Movc A, @ A + DPTR iii) PUSH addr iv) SETB psw . 4
v) RL A **(10 Marks)**

OR

4 a. Write an ALP in 8051 to exchange the contents of registers R7 and R6 in register Bank 0 in five different ways. **(10 Marks)**

b. Explain the different types of conditional and unconditional jump instructions of 8051. Specify the different range associated with jump instruction. **(10 Marks)**

Module-3

5 a. Assume that the RAM locations 40h-44h have the following values. Write an ALP to find the sum of the values. Store the low byte of the result in A register and high byte of the result in R7 register, (involving loops in program)
40h – (70)
41h = (EBG)
42h = (C5h)
43h = (5Bh)
44h = (30h) **(10 Marks)**

b. Write an ALP in 8051 to move a block of data stored in external memory location 9000h to a location starting from foooh. Block length N = 5. **(10 Marks)**

OR

6 a. Using registers write a subroutine to get
   i) A delay of 5 msec, assume the crystal oscillator frequency is 22MHZ show delay calculations.
   ii) A delay of 200msec, assume the crystal frequency is 11.0592MHZ show the delay calculations. **(10 Marks)**

b. Design a circuit to interface a simple LED and a switch to 8051μc. Write an ALP in 8051 to turn LED ON/OFF, if the content of the internal bit addressable memory location 20h content is 01 or ooh respectively. LED is connected to pin p2.0, switch (sw) connected to p1.0. **(05 Marks)**

c. Briefly explain about stack and stack operations. **(05 Marks)**

Module-4

7 a. With regard to timers of 8051
   i) Explain TMOD and TCON registers with its bit pattern.
   ii) Indicate how to start/stop timer if GATE control is also used. **(10 Marks)**

b. Explain mode 2 programming with neat sketch and specify the program steps. **(05 Marks)**

c. Write an assembly language program in 8051 to generate a pulse using mode-1 on a port pin p1.4 with delay of pulse as 1ms, crystal frequency of 11.0592 MHz. Show delay calculation. **(05 Marks)**

OR

8 a. List the advantages of serial communication over parallel communication. **(06 Marks)**

b. Explain briefly the asynchronous serial communication format with an example. **(04 Marks)**

c. Write an 8051 ALP and C program for the 8051 to transfer the letter 'A' serially at 4800 baud rate continuously. Use 8 bit data and 1 stop bit. **(10 Marks)**

Module-5

9 a. With regard to the interrupt of 8051:
   i) Give the vector addresses of the interrupts.
   ii) Briefly explain the procedure of enabling/disabling the entire interrupt system and enabling/disabling of individual interrupts.
   iii) What are the steps micro controller to perform up on activation of an interrupt. **(10 Marks)**

b. Show the interfacing of a stepper motor to 8051. A switch is connected to (SW) pin P3.2. Write an assembly language program to monitor the status of SW and perform the following:
   i) If SW = 0 the stepper motor moves clockwise
   ii) If SW = 1 the stepper motor moves anti clockwise. **(10 Marks)**

OR

10 a. Write an ALP to generate a square wave of 5kHz on pin P1.2. Using an interrupt generated from timer 0 of 8051μc, crystal frequency 22MHZ. **(08 Marks)**

b. Interface an LCD display to 8051 and write an ALP to display the characters 'A' 'B' 'C'. **(12 Marks)**

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18ES51

Fifth Semester B.E. Degree Examination, Jan./Feb. 2023
Technological Innovation Management and Entrepreneurship

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the various functions of Management. **(07 Marks)**

b. Describe the various roles of a Manager. **(07 Marks)**

c. Distinguish between Management and Administration. Draw the diagram for time spent in administrative and managerial functions at different levels. **(06 Marks)**

OR

2 a. Define planning. Describe the importance of planning. **(08 Marks)**

b. Explain all the steps in Rational Decision making with a neat diagram. **(08 Marks)**

c. Give the differences between programmed and non-programmed decisions. **(04 Marks)**

Module-2

3 a. Explain the span of management concept its meaning and importance. **(05 Marks)**

b. Define committee. Explain the different types of committees. **(05 Marks)**

c. What is Recruitment? Explain the steps in the selection process. **(10 Marks)**

OR

4 a. Write about the requirements of effective direction. **(08 Marks)**

b. Discuss Autocratic, Democratic and Free rein Leadership styles. **(08 Marks)**

c. Explain the meaning of control. Write the benefits of control. **(04 Marks)**

Module-3

5 a. Explain the meaning of social responsibility. Describe the social responsibilities of Business towards consumer and community. **(06 Marks)**

b. What is Social Audit? What are its benefits and limitations? **(07 Marks)**

c. What is Corporate Governance? List the benefits of good Corporate Governance. **(07 Marks)**

OR

6 a. Define Entrepreneurship. Explain the different types of Entrepreneurs. **(08 Marks)**

b. Explain Entrepreneurial development cycle. **(07 Marks)**

c. List and explain any five characteristics of an entrepreneur. **(05 Marks)**

Module-4

7 a. Define Family Business. Explain the characteristics of a family owned business in India. **(07 Marks)**

b. Explain the various types of family businesses. **(07 Marks)**

c. Write the contributions of family businesses in India. Also explain the stages of development of family business. **(06 Marks)**

OR

8	a.	Explain the ways of generating business ideas.	**(08 Marks)**
	b.	Explain how to identify a business opportunity.	**(06 Marks)**
	c.	Explain the concept of Financial Feasibilities.	**(06 Marks)**

Module-5

9	a.	What is the purpose of a Business plan? Explain. Also write the reasons for preparing a business plan.	**(07 Marks)**
	b.	Why do some business plans fail? Explain.	**(07 Marks)**
	c.	Explain the following terms: i) Venture capital ii) Angel Investing	**(06 Marks)**

OR

10	a.	Explain the six stages of venture capital financing as identified by Tyebjee and Bruno.	**(08 Marks)**
	b.	Discuss the steps in PERT network analysis technique. What are its advantages?	**(08 Marks)**
	c.	List differences between PERT and CPM.	**(04 Marks)**

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18EC52

Fifth Semester B.E. Degree Examination, Jan./Feb. 2023
Digital Signal Processing

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. State and prove circular time shift property. **(06 Marks)**

b. Find the 4-point DFT of the sequence $x(n) = \text{Cos}\left(\frac{\pi}{4}n\right) + \text{Sin}\left(\frac{\pi}{4}n\right)$ use linearity property. **(08 Marks)**

c. Consider 4-point sequences $x(n) = \text{Cos}\left(\frac{\pi n}{2}\right); 0 \le n \le 3$

$h(n) = 2^n ; \ 0 \le n \le 3$

Compute circular convolution. Using concentric circle method. **(06 Marks)**

OR

2 a. State and prove Parseval's theorem. **(06 Marks)**

b. Find 6- point DFT of the sequence

$x(n) = n ; \quad 0 \le n \le 5$

$= 0 ; \quad$ otherwise **(08 Marks)**

c. Find the IDFT of the DFT $X(K) = \{6, -2 + j2, -2, -2 - j2\}$. **(06 Marks)**

Module-2

3 a. Consider a FIR with filter whose impulse response $h(n) = \{3, 2, 1, 1\}$ if the input is $x(n) = \{1, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1\}$, find the output using over lap add method assuming the length of block as 7. **(10 Marks)**

b. Develop Radix- 2 DIT-FFT algorithm and draw complete signal flow graph for N = 8. **(10 Marks)**

OR

4 a. Find the output y(n) of a filter whose impulse response in $h(n) = \{1, 1, 1\}$ and the input signal to the filter is $x(n) = \{3, -1, 0, 1, 3, 2, 0, 1, 2, 1\}$. Using overlap save method. **(10 Marks)**

b. First five point of the Eight point DFT of a real valued sequence is given by

$x(0) = 0, \qquad x(3) = 2 - 2j$

$x(1) = 2 + 2j \quad x(4) = 0$

$x(2) = -j4$

Determine the remaining points. Hence find the original sequence x(n) using Decimation in frequency FFT algorithm. **(10 Marks)**

Module-3

5 a. List the different types of windowing techniques used in the design of FIR filters. Write the analytical equations, draw the magnitude response and show the largest side lobe value below the dc magnitude. **(08 Marks)**

b. The frequency response of an FIR filter is given by

$H(\omega) = e^{-j3\omega}(1 + 1.8\cos 3\omega + 1.2\cos 2\omega + 0.5\cos\omega)$

Determine the coefficient of the impulse response h(n) of the FIR filter. **(06 Marks)**

c. Determine the coefficient K_m of the lattice filter corresponding to FIR filter described by the system function $H(z) = 1 + 2z^{-1} + \frac{1}{3}z^{-2}$. And also draw the Lattice structure. **(06 Marks)**

OR

6 a. Determine the filter coefficient $h_d(n)$ for the desired frequency response of a Lowpass filter is given by

$$H_d(w) = \begin{cases} e^{-j2w} & ; \ -\frac{\pi}{4} \le w \le \frac{\pi}{4} \\ 0 & ; \ \frac{\pi}{4} \le w \le \pi \end{cases}$$

Find h(n) and also frequency response H(w) using Hamming window. **(10 Marks)**

b. Obtain the cascade form realization of system function :

$H(z) = 1 + 5z^{-1} + 2z^{-2} + 2z^{-3}$ **(05 Marks)**

c. Realize the following function in Direct form.

$H(z) = \left(1 + \frac{1}{2}z^{-1} + z^{-2}\right)\left(1 + \frac{1}{4}z^{-1} + z^{-2}\right)$ **(05 Marks)**

Module-4

7 a. Discuss the general procedure for IIR filter design using Bilinear transformation. **(06 Marks)**

b. An analog filter is given by $H_a(s) = \frac{s + 0.1}{(s + 0.1)^2 + 16}$. Obtain digital IIR filter using bilinear transformation method. Digital filter is to have resonant frequency $\omega_r = \frac{\pi}{2}$ radians. **(08 Marks)**

c. Compare FIR and IIR filter. **(06 Marks)**

OR

8 a. Design a Butterworth digital low pass filter with the following specifications.
   i) 3dB attenuation at the passband frequency of 1.5KHz
   ii) 10dB stopband attenuation at the frequency of 3KHz
   iii) Sampling frequency of 8000Hz. **(10 Marks)**

b. A system is represented by a transfer function H(z) is given by $H(z) = 1 + \frac{4z}{z - \frac{1}{2}} - \frac{2}{z - \frac{1}{4}}$
   i) Does this H(z) represent a FIR or IIR filter? Why?
   ii) Draw direct form – I and Direct form – II realization by showing all differences equations? **(10 Marks)**

Module-5

9 a. Explain IEEE floating point formats using :
   i) Single precision format ii) Double precision format. **(08 Marks)**

b. Discuss briefly multiplier and Accumulator unit in Digital signal processor hardware units. **(04 Marks)**

c. Draw the block diagram to TMS320C3X floating point digital signal processor. **(08 Marks)**

OR

10 a. With block diagram explain Digital signal processor based on Harvard architecture. **(06 Marks)**

b. Convert the Q-15 signed number to decimal numbers.
   i) 1.110101110000010 ii) 0.100011110110010 **(04 Marks)**

c. Explain the basic architecture of TMS320CS54X used in fixed point Digital signal processor. **(10 Marks)**

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18EC53

Fifth Semester B.E. Degree Examination, Jan./Feb. 2023
Principles of Communication Systems

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. With proper necessary equations, explain the time domain and frequency domain expressions for an AM wave. Outline the waveforms and spectrum. **(08 Marks)**

b. Explain the generation of AM wave using switching modulator with neat block diagram and relevant equations. **(08 Marks)**

c. An audio frequency signal $10\sin 2\pi(500t)$ is used to amplitude modulate a carrier signal of $50\sin 2\pi(10^5 t)$. Assume modulation index as 0.2. Determine

(i) Side band frequencies.
(ii) Amplitude of each sideband.
(iii) Band width required. **(04 Marks)**

OR

2 a. What is a coherent detector used for DSB.SC? Why it is so named? Explain its working with a neat block diagram. What can be the problems in a coherent detector? **(08 Marks)**

b. Compare and contrast standard AM, DSB-SC, SSB-SC and VSB-SC (at least 5 points in each) **(05 Marks)**

c. When the modulation percentage is 75 an AM transmitter produces 10 kW. How much of this is carrier power? Determine the percentage of power saving if the carrier and one of the sidebands were suppressed before transmission took place. **(07 Marks)**

Module-2

3 a. From the fundamentals deduct an expression of WBFM and plot its frequency spectrum. **(10 Marks)**

b. What is frequency modulation? Deduct the expression for a narrow band FM signal. Represent a narrow band FM signal with neat phasor diagram. **(08 Marks)**

c. A FM signal has sinusoidal modulation with $W = 15$ kHz and modulation index $\beta = 2$. Using Carson's rule determine the transmission bandwidth and deviation ratio. Assume $\Delta f = 75$ kHz. **(02 Marks)**

OR

4 a. With relevant mathematical analysis and block diagrams show the reconstruction of message signal from FM wave using PLL. **(10 Marks)**

b. Explain the generation of FM wave using a neat block diagram and necessary equations. **(06 Marks)**

c. A Carrier is frequency modulated by a sinusoidal modulating signal of frequency 3 kHz resulting in a frequency deviation of 10 kHz.

(i) What is the bandwidth occupied by the modulated waveform?
(ii) If the amplitude of the modulating signal is increased by a factor of 2 and its frequency is lowered to 1 kHz. Determine the new bandwidth. **(04 Marks)**

Module-3

5 a. What is thermal Noise? List out different characteristics of thermal Noise. **(06 Marks)**

b. What is white noise? Deduct the power spectral density and auto-correlation function for a RC-Low pass filtered white Noise. Also find the Noise equivalent bandwidth for the same and show its relationship with normal bandwidth. **(08 Marks)**

c. Explain the applicability of pre-emphasis and de-emphasis with respect to FM system. **(06 Marks)**

OR

6 a. Determine the FOM for a DSB-SC receiver. **(08 Marks)**

b. Determine the FOM for a standard AM receiver. **(08 Marks)**

c. Explain capture effect and threshold effect with respect to FM receiver. **(04 Marks)**

Module-4

7 a. What are the advantages of digital modulation techniques over analog? **(04 Marks)**

b. What is sampling theorem? Explain sampling with neat sketches and equations. What are the challenges faced with Nyquist criteria of sampling? **(08 Marks)**

c. What is Flat top sampling writ PAM. Explain the same with neat waveforms and derive the equation for flat-top sampled PAM. **(08 Marks)**

OR

8 a. What is multiplexing and why it is required in communication? Explain the working of TDM with neat block diagram. **(08 Marks)**

b. What is pulse position modulation? Explain the generation of a PPM wave with neat block diagram and necessary waveforms. **(08 Marks)**

c. What is aperture error in PAM? How to minimize it? **(04 Marks)**

Module-5

9 a. What is Quantization? Why it is required in digital communication? Explain symmetric quantizer of midtread and midrise type. **(08 Marks)**

b. With neat block diagram, explain the working of PCM system. **(08 Marks)**

c. What is companding? Explain different laws of companding. **(04 Marks)**

OR

10 a. What is Quantization noise? Derive the expression for O/P signal to Noise Ratio of a Quantizer. Consider a sinusoidal modulating signal of amplitude AM which uses all representation levels provided. Calculate the $(SNR)_O$ for the O/P of quantizer of the above signal. **(08 Marks)**

b. What is Delta modulation? Explain the same with block diagrams. **(06 Marks)**

c. Write a note on Vocadens. **(06 Marks)**

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18EC54

Fifth Semester B.E. Degree Examination, Jan./Feb. 2023

Information Theory & Coding

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define the followings:
   (i) Entropy
   (ii) Information rate.
   (iii) Self information. **(06 Marks)**

b. A binary source is emitting an independent sequence of 0's and 1's with probability of P and 1-P respectively. Plot the Entropy of this source versus P (0<P<1). **(06 Marks)**

c. For the first order Markov statistical model shown in Fig. Q1 (c). Compute
   (i) Probabilities of each state.
   (ii) H(s) and $H(s^{-2})$

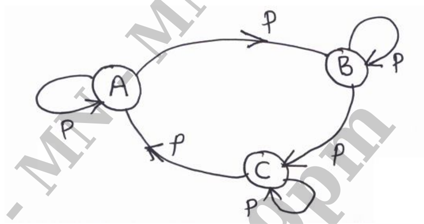

Fig. Q1 (c) **(08 Marks)**

OR

2 a. For the first order Markoff model shown in Fig. Q2 (a). Find
   (i) Entropy of each state.
   (ii) Entropy of the source.
   (iii) Prove that $G_1 \geq G_2 \geq H$

Assume $P(1) = P(2) = P(3) = \frac{1}{3}$

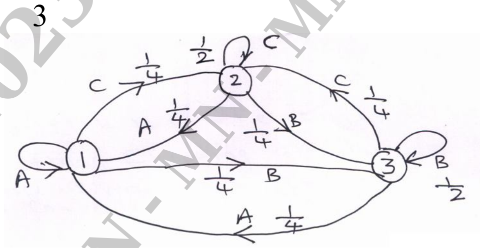

Fig. Q2 (a) **(12 Marks)**

b. The international Morse code uses a sequence of dots and dashes to transmit letters of the English alphabets. The dash represented by a current pulse that has a durationof 3 units and the dot has a duration of 1 unit. The probability of a dash is $\frac{1}{3}$ of the probability of occurrence of a dot.
   (i) Calculate the information content of a dot and a dash.
   (ii) Calculate H(s) in the dot-dash code.
   (iii) Assume that the dot lasts 1 msec.
   Which is the same time interval as the pause between symbols? Find the average rate of information transmission. **(08 Marks)**

Module-2

3 a. Construct a binary Shannon encoding algorithm for the following source with probabilities:
$S = \{A, B, C, D, E\}$
$P = \{0.4, 0.25, 0.15, 0.12, 0.08\}$
Also compute the code Efficiency. **(08 Marks)**

b. What is prefix of a code and explain with example. **(04 Marks)**

c. Construct a Ternary code using Huffman Encoding algorithm for the source given with probabilities and move the composite symbol as low as possible.

Symbol :	A	B	C	D	E	F	G
Probabilities :	$\frac{1}{3}$	$\frac{1}{27}$	$\frac{1}{3}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{27}$	$\frac{1}{27}$

Also find the code efficiency. **(08 Marks)**

OR

4 a. Check the following codes given in Table (1) are instantaneous or not with the help of KMI.

Symbols	Code A	Code B	Code C
A	0	0	00
B	10	11	01
C	110	100	10
D	1110	110	111
E	1111	1011	0110

Table (1) **(09 Marks)**

b. Design a source Encoder using Shannon encoding algorithm for the information source shown in Fig.Q4 (b). Compute the average output bit rate and efficiency of the code for $N = 1$. Assume $P_1 = P_2 = \frac{1}{2}$.

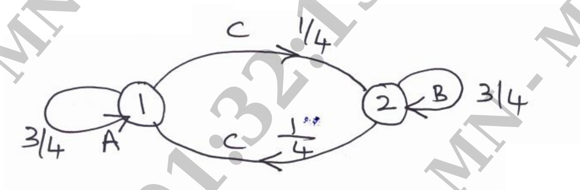

Fig. Q4 (b) **(11 Marks)**

Module-3

5 a. Define the followings:
(i) Channel matrix.
(ii) Joint probability matrix.
(iii) Input entropy.
(iv) Output entropy. **(08 Marks)**

b. What is mutual information? Prove that $I(X, Y) \geq 0$. **(08 Marks)**

c. Determine the capacity of the channel shown in Fig. Q5 (c).

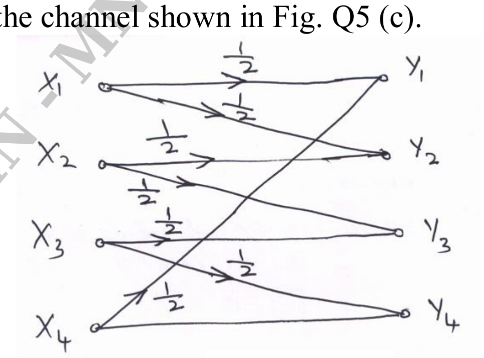

Fig. Q5 (c) **(04 Marks)**

OR

6 a. Consider a channel matrix, $P\left(\frac{Y}{X}\right) = \begin{bmatrix} 0.6 & 0.2 & 0.2 \\ 0.2 & 0.6 & 0.2 \\ 0.2 & 0.2 & 0.6 \end{bmatrix}$

with $P(X_1) = P(X_2) = P(X_3) = \frac{1}{3}$

Find H(X), H(Y), H(X,Y), $H\left(\frac{Y}{X}\right)$ and $H\left(\frac{X}{Y}\right)$. **(08 Marks)**

b. The noise characteristic of a channel as shown in Fig. Q6 (b). Find the capacity of a channel using Muruga's method. Assume γ_s = 1500 symbols/sec.

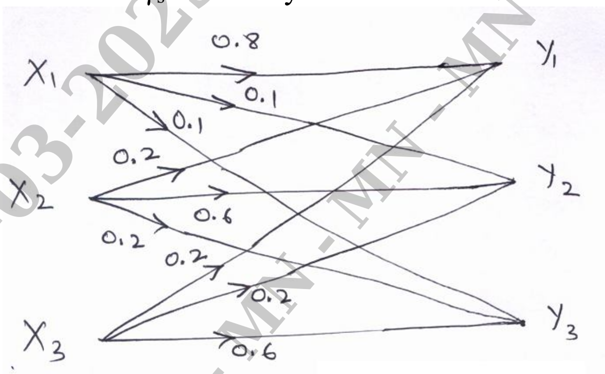

Fig. Q6 (b) **(08 Marks)**

c. Explain Binary Erasure channel. **(04 Marks)**

Module-4

7 a. Define the following:
   (i) Hamming weight.
   (ii) Hamming distance.
   (iii) Minimum distance. **(06 Marks)**

b. For a (6, 3) linear block code, the parity matrix is,

$$P = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}.$$

   (i) Obtain the generator matrix.
   (ii) Write all possible code words.
   (iii) If the received code vector R = 1 1 1 0 1 0, detect and correct the single error.
   (iv) Draw the encoder and syndrome calculation block diagram. **(14 Marks)**

OR

8 a. A Generator polynomial for a (15, 7) cyclic code is $g(x) = 1 + x^4 + x^6 + x^7 + x^8$.
   (i) Find the code vector for the message $D(x) = x^2 + x^3 + x^4$ using encoder circuit.
   (ii) Draw the syndrome calculation circuit and find the syndrome of the received polynomial.

$$z(x) = 1 + x + x^3 + x^6 + x^8 + x^9 + x^{11} + x^{14}$$ **(16 Marks)**

b. Mention the advantages and disadvantages of error control coding. **(04 Marks)**

Module-5

9 a. Consider the (3, 1, 2) convolution encoder with $g_{(1)} = 110$, $g_{(2)} = 101$ and $g_{(3)} = 111$
   (i) Draw the encoder diagram.
   (ii) Find the code word for the message sequence (11101) using generator matrix/matrix method.
   (iii) Find the code word for the message sequence (11101) using transform domain approach. **(16 Marks)**

   b. What are convolution codes? How it is different from block codes. **(04 Marks)**

OR

10 The (2, 1, 2) convolution encoder shown in Fig. Q10.
   (i) Draw state transition table.
   (ii) State diagram.
   (iii) Draw the code tree and find the encoder output produced by the message (110)
   (iv) Construct a Trellis diagram and find the encoder output produced by the message (110)

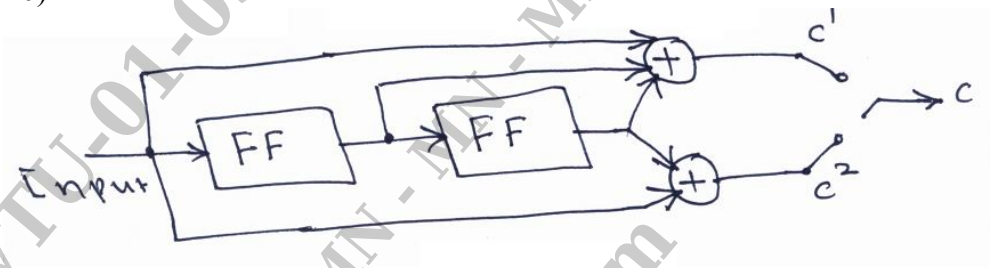

Fig. Q10 **(20 Marks)**

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CBCS SCHEME

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18EC55

Fifth Semester B.E. Degree Examination, Jan./Feb. 2023
Electromagnetic Waves

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. The three vertices of a triangle are located at $A(6, -1, 2)$, $B(-2, 3, -4)$ and $C(-3, 1, 5)$. Find (i) $R_{AB} \times R_{AC}$ (ii) Area of triangle **(04 Marks)**

b. Define Electric field intensity. Derive the expression for electric field intensity due to infinite line charge. **(10 Marks)**

c. Given the electric flux density $\overline{D} = 0.3r^2 \bar{a}_r nC/m^2$ in free space.
 (i) Find E at point $P(r = 2, \theta = 25^\circ, \phi = 90^\circ)$.
 (ii) Find total charge within the sphere r = 3.
 (iii) Find total electric flux learing the sphere r = 4. **(06 Marks)**

OR

2 a. Four identical 3nC (nano Coulomb) charges are located at $P_1(1, 1, 0)$, $P_2(-1, 1, 0)$, $P_3(-1, -1, 0)$ and $P_4(1, -1, 0)$. Find the electric field intensity $\overline{E}$ at $P(1, 1, 1)$. **(10 Marks)**

b. Infinite uniform line charges of 5 nC/m lie along the (positive and negative) x and y axes in free space. Find $\overline{E}$ at $P_A(0, 0, 4)$. **(04 Marks)**

c. Define Coulomb's law. Make use of this to find the force on Q_1. Given that the point charges $Q_1 = 50\,\mu C$ and $Q_2 = 10\,\mu C$ are located at $(-1, 1, -3)$m and $(3, 1, 0)$m respectively. **(06 Marks)**

Module-2

3 a. Explain Gauss law applicable to the case of infinite line charge and derive the relation used. **(08 Marks)**

b. Evaluate both sides of the divergence theorem for the field $\overline{D} = 2xy\overline{a_x} + x^2\overline{a_y}$ C/m^2 and the rectangular parallelepiped formed by the places x = 0 and 1, y = 0 and 2 and z = 0 and 3. **(08 Marks)**

c. Given the potential field $V = 2x^2y - 5z$ and point $P(-4 \quad 3 \quad 6)$. (i) Find potential V at P. (ii) Field intensity $\overline{E}$, (iii) Volume charge density ρ_V. **(04 Marks)**

OR

4 a. Compute the numerical value for $\text{div}\,\overline{D}$ at the point specified below:
$\overline{D} = (2xyz - y^2)\bar{a}_x + (x^2z - 2xy)\bar{a}_y + x^2y\bar{a}_z$ C/m^2 at $P_A(2, 3, -1)$ **(04 Marks)**

b. Show that Electric field is a negative gradient of potential. **(08 Marks)**

c. Let $E = y\bar{a}_x$ V/m at a certain instant of time and calculate the work required to move a 3c charge from $(1, 3, 5)$ to $(2, 0, 3)$ along the straight line segment joining
 (i) $(1, 3, 5)$ to $(2, 3, 5)$ to $(2, 0, 5)$ to $(2, 0, 3)$
 (ii) $(1, 3, 5)$ to $(1, 3, 3)$ to $(1, 0, 3)$ to $(2, 0, 3)$ **(08 Marks)**

Module-3

5 a. Solve the Laplace's equation for the potential field in the homogenous region between the two concentric conducting spheres with radii 'a' and 'b' such that b>a, if potential V = 0 at r = b and $V = V_0$ at r = a. Also find the capacitance between two concentric spheres. **(10 Marks)**

b. State and explain Biot-Savart law applicable to magnetic field. **(06 Marks)**

c. Calculate the value of vector current density in a rectangular coordinates at $P_A(2, 3, 4)$ if $\bar{H} = x^2 z\bar{a}_y - y^2 x\bar{a}_z$. **(04 Marks)**

OR

6 a. State and illustrate uniqueness theorem. **(08 Marks)**

b. Define Stoke's theorem. Use this theorem to evaluate both sides of the theorem for the field $\bar{H} = 6xy\bar{a}_x - 3y^2\bar{a}_y$ A/M and the rectangular path around the region, $2 \le x \le 5$, $-1 \le y \le 1$ $z = 0$. Let the positive direction of ds be $\bar{a}_z$. **(12 Marks)**

Module-4

7 a. Obtain the expression for magnetic force between differential current elements. **(06 Marks)**

b. Derive the boundary conditions to apply to $\bar{B}$ and $\bar{H}$ at the interface between two different magnetic materials. **(08 Marks)**

c. The point charge $\theta = 18nC$ has a velocity of 5×10^6 m/s in the direction.
$\bar{a}_v = 0.60\bar{a}_x + 0.75\bar{a}_y + 0.30\bar{a}_z$
Calculate the magnitude of the force exerted on the charge by the field,

(i) $\bar{B} = -3\bar{a}_x + 4\bar{a}_y + 6\bar{a}_z$ mT

(ii) $\bar{E} = -3\bar{a}_x + 4\bar{a}_y + 6\bar{a}_z$ kV/m

(iii) B and $\bar{E}$ acting together **(06 Marks)**

OR

8 a. Find the magnetization in a magnetic material, where

(i) $\mu = 1.8\times10^{-5}$ H/m and $H = 120$ A/m

(ii) $\mu_r = 22$, there are 8.3×10^{28} atoms/m^3, and each atom has a dipole moment of 4.5×10^{-27} A.m^2

(iii) $B = 300\,\mu T$ and $\chi_m = 15$. **(06 Marks)**

b. Let permittivity be 5 μH/m in region A where x < 0 and 20 μH/m in region B, where x > 0. If there is a surface current density $\bar{K} = 150\bar{a}_y - 200\bar{a}_z$ A/m at x = 0, and if $H_A = 300\bar{a}_x - 400\bar{a}_y + 500\bar{a}_z$ A/m. Compute

(i) $|H_{tA}|$ (ii) $|H_{NA}|$ (iii) $|H_{tB}|$ (iv) $|H_{NB}|$ **(08 Marks)**

c. State and explain Faraday's law of electromagnetic induction. **(06 Marks)**

Module-5

9 a. List and explain Maxwell's equations in point and integral form. **(08 Marks)**

b. The time domain expression for the magnetic field of a uniform plane wave travelling in free space is given by,

$H(z,t) = \bar{a}_y 2.5\cos(1.257\times10^9 t - K_0 z)$ mA/m.

Compute

(i) The direction of wave propagation.

(ii) Operating frequency

(iii) Phase constant.

(iv) The time domain expression for electric field E(z,t) starting from the Maxwell's equations.

(v) The phasor form of both the electric and magnetic field. **(10 Marks)**

c. For silver the conductivity is $\sigma = 3\times10^6$ S/m. At what frequency will the depth of penetration be 1 mm. **(02 Marks)**

OR

10 a. State and explain Poynting theorem and write the equation both in point and integral form. **(08 Marks)**

b. Simplify the value of K to satisfy the Maxwell's equations for region $\sigma = 0$ and $\rho_v = 0$ if $\bar{D} = 10x\bar{a}_x - 4y\bar{a}_y + kz\bar{a}_z\ \mu C/m^2$ and $B = 2\bar{a}_y$ mT. **(06 Marks)**

c. A plane wave of 16 GHz frequency and E = 10 V/m propagates through the body of salt water having constant $\varepsilon_r = 100$, $\mu_r = 1$ and $\sigma = 100$ s/m. Determine attenuation constant, phase constant, phase velocity and intrinsic impedance and depth and penetration. **(06 Marks)**

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CBCS SCHEME

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18EC56

Fifth Semester B.E. Degree Examination, Jan./Feb. 2023
Verilog HDL

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Explain typical design flow for designing VLSI circuit using the flow chart. **(08 Marks)**

b. i) A 4-bit ripple carry adder (Ripple – Add) contains four 1-bit full adders (FA). Define the module FA. Do not define the internals or the terminal list. Define the module Ripple – Add. Do not define the internals or the terminal list. Instantiate four full adder of the type FA in the module Ripple-Add and call them fa0, fa1, fa2, and fa3.

ii) Define the module IS, using the module/endmodule keywords. Instantiate the modules MEM, Se, Xbar and call the instances mem1, se1 and Xbar 1, respectively. You do not need to define the internals. Assume that the module IS has no terminals. **(06 Marks)**

c. What are the two styles of stimulus applications? Explain each method in brief. **(06 Marks)**

OR

2 a. Explain the trends in HDL. **(04 Marks)**

b. With a hierarchical diagram of a 4-bit ripple carry counter, explain the design hierarchy **(10 Marks)**

c. What is the difference between a module and a module instance? Explain with an example. **(06 Marks)**

Module-2

3 a. Describe different methods of connecting parts to internal signals. **(06 Marks)**

b. Explain $ display, $ monitor, $ finish and $ stop system tasks with examples. **(08 Marks)**

c. What are the basic components of a module? Explain all the components of a verilog module with a neat diagram. **(06 Marks)**

OR

4 a. Declare the following variables in verilog.

i) An 8-bit vector net called a – in

ii) A 16-bit hexadecimal unknown number with all x's

iii) A memory MEM containing 256 words of 64 bits each

iv) A parameter cache-size equal to 512. **(04 Marks)**

b. With example explain different types of lexical conventions. **(08 Marks)**

c. Write verilog description of SR latch. Also write stimulus code. **(08 Marks)**

Module-3

5 a. Write a verilog dataflow description for 4-bit full adder with carry lookahead. **(06 Marks)**

b. What would be the output of the following

$a = 4'b1010$, $b = 4'b1111$

i) a&b (ii) a&&b (iii) &a (iv) a>>1 (v) a>>>1

(vi) $y = \{2\{a\}\}$ (vii) $a \wedge b$ (viii) $z = \{a, b\}$ **(08 Marks)**

c. What re rise, fall and Turn-off delays? How they are specified in verilog? **(06 Marks)**

OR

6 a. A full subtractor has three 1-bit inputs x, y and z (previous borrow) and two 1-bit outputs D (Difference) and B (Borrow) the logic equations are

$D = \bar{X}\bar{Y}Z + \bar{X}Y\bar{Z} + X\bar{Y}\bar{Z} + XYZ$

$B = \bar{X}Y + \bar{X}Z + YZ$ **(06 Marks)**

Write veriolog description using dataflow modeling. Instantiate the subtractor inside a stimulus block and test all possible combinations of inputs X, Y and Z.

b. Discuss the And/or and Not gates with respect to logic symbols, gate instantiation and truth table. **(06 Marks)**

c. Design AND-OR-INVERT (AOI) based 4:1 multiplexer write verilog description for the same and its stimulus. **(08 Marks)**

Module-4

7 a. Explain the following assignment statements and non-blocking assignment statements with relevant examples. **(06 Marks)**

b. Write a veriolog program for 8-to-1 multiplexer using case statement. **(08 Marks)**

c. Give the differences between tasks and functions. **(06 Marks)**

OR

8 a. Explain sequential and parallel blocks with examples. **(06 Marks)**

b. Design a negative edge-triggered D-flipflp (DUFF) with synchronous clear, active high (D-FF clears only at a negative edge of clock when clear is high). Design a clock with a period of 10 units and test the D-flipflop. **(08 Marks)**

c. Write verilog program to call a function called calc-parity which computes the parity of a 32-bit data, [31-0] Data and display odd or even parity message. **(06 Marks)**

Module-5

9 a. Write a note on :

i) Force and release
ii) Defparam statement
iii) time scale
iv) file output. **(08 Marks)**

b. Write a note on verification of gate level netlist. **(04 Marks)**

c. With a neat flow chart explain computer Aided logic synthesis process. **(08 Marks)**

OR

10 a. What is logic synthesis? **(04 Marks)**

b. Interpret the following verilog constructs after logic synthesis.

i) The assign statement
ii) The if-else statement
iii) The case statement
iv) The always statement **(10 Marks)**

c. Write RTL description for magnitude comparator. **(06 Marks)**

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18EC61

Sixth Semester B.E. Degree Examination, Jan./Feb. 2023
Digital Communication

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain Hilbert transform and its properties. **(10 Marks)**

b. Derive the expression for the complex low pass representation of band pass system. **(10 Marks)**

OR

2 a. Describe the canonical representation of Band-pass signal. **(10 Marks)**

b. Find out the hibert transform of

i) $g(t) = \cos 2\pi Ft + \sin 2\pi Ft$

ii) $g(t) = e^{-j2\pi Ft}$. **(04 Marks)**

c. Sketch the line code for the binary sequence 10110011 i) Unipolar NRZ ii) Unipolar RZ iii) Manchester coding. **(06 Marks)**

Module-2

3 a. Describe the geometric representation of signals. Also show that energy of the signal is equal to squared length of the vector representing it. **(10 Marks)**

b. Find out the expression of mean, variance and covariance of correlator outputs. **(10 Marks)**

OR

4 a. Explain the correlation receiver and matched filter receiver with relevant diagrams. **(10 Marks)**

b. Apply Gram-Schmidt procedure to obtain an orthonormal basis for the signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ as shown in Fig.Q.4(b). Write $s_1(t)$, $s_2(t)$ and $s_3(t)$ interms of orthonormal basis function.

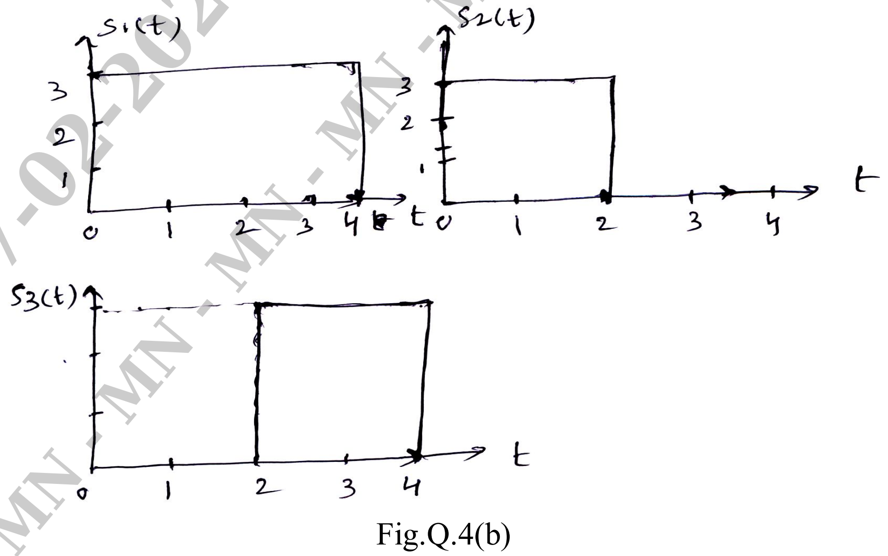

Fig.Q.4(b)

(10 Marks)

Module-3

5 a. Describe with neat diagram the generation and detection of BPSK. Also derive the probability of error for coherent detection. **(10 Marks)**

b. Using block diagram, explain the generation and detection of QPSK signal. **(10 Marks)**

OR

6 a. Derive the expression for average probability of error for FSK using coherent detection. Explain transmitter and coherent receiver of FSK. **(10 Marks)**

b. Explain with block diagram the non-coherent detection of FSK signals. **(06 Marks)**

c. Encode the binary sequence using DPSK 11011011. Assume reference bit as '1'. **(04 Marks)**

Module-4

7 a. Explain the digital PAM transmission system. Also derive the expression for Inter Symbol Interference (ISI). **(10 Marks)**

b. Illustrate the due-binary and modified duo-binary signals in time-domain and frequency domain. **(10 Marks)**

OR

8 a. Describe the Nyquist criterion for distortion less base band binary transmission and find out the ideal solution for zero-ISI. **(10 Marks)**

b. The input to the preorder is a binary sequence 1 0 0 1 0 1 1 0 0. Obtain the preceded sequence, transmitted amplitude levels, the received signal levels and the decoded sequence for due-binary system. **(06 Marks)**

c. Write short note on-eye diagram. **(04 Marks)**

Module-5

9 a. Illustrate the working of Direct-sequence spread spectrum transmitter and receiver with block diagram, waveforms and expression. **(10 Marks)**

b. Explain frequency hop spread spectrum system with neat block diagram. **(10 Marks)**

OR

10 a. Illustrate the CDMA system forward link base on IS-95. **(10 Marks)**

b. Write note on application of spread spectrum in wireless LAN's. **(04 Marks)**

c. Obtain the PN sequence from the given PN sequence generator, assume 100 is a initial state. **(06 Marks)**

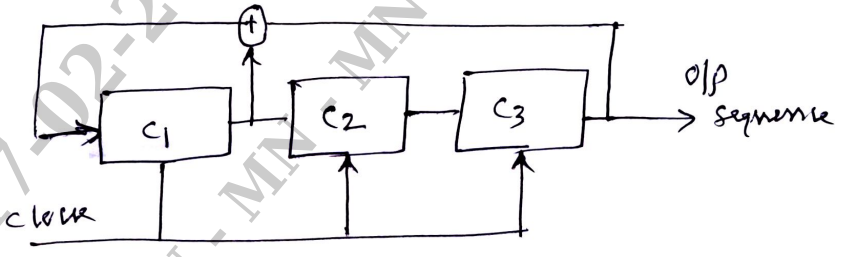

Fig.Q.10(c)

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18EC62

Sixth Semester B.E. Degree Examination, Jan./Feb. 2023
Embedded Systems

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. With a neat diagram, explain the architecture of ARM crotox M_3 processor. **(10 Marks)**

b. Explain two stack model and reset sequence of ARM cortex M_3. **(10 Marks)**

OR

2 a. With the help of neat diagram, explain operation modes and privilege levels of cortex M_3. **(10 Marks)**

b. With the help of register bit format, explain XPSR register in detail. **(06 Marks)**

c. Explain the function of special registers PRIMASK, BASEPRI, CONTROL, FAULTMASK. **(04 Marks)**

Module-2

3 a. Explain the operation of following instructions with syntax and an example for each:
i) ADD.W ii) LDMIA iii) BEQ iv) LSR v) IF-THEN. **(10 Marks)**

b. Explain different rotate and reverse instructions of cortex M_3 with example for each. **(10 Marks)**

OR

4 a. Explain SSAT and USAT saturation instructions with an example. **(05 Marks)**

b. Write an assembly language program to multiply two numbers. **(05 Marks)**

c. With a neat diagram, explain the CMSIS organization, operation, benefits and disadvantages. **(10 Marks)**

Module-3

5 a. Define embedded system. Classify an embedded system based on i) Generation ii) Complexity iii) Triggering. **(10 Marks)**

b. Explain the purpose of an embedded system. **(06 Marks)**

c. Mention the application of an embedded system in different domains. **(04 Marks)**

OR

6 a. Differentiate between RISC and CISC. **(06 Marks)**

b. With a neat interface diagram, explain the onboard I^2C communication bus. **(08 Marks)**

c. Explain the following:
i) Optocoupler ii) Zig-bee iii) Wi-fi, **(06 Marks)**

Module-4

7 a. Define and explain operational and non operational quality attributes of an embedded system. **(10 Marks)**

b. With a block diagram, explain the role of different components of washing machine. **(07 Marks)**

c. Explain super loop based approach for embedded firmware design. **(03 Marks)**

OR

8 a. With a neat flow diagram, explain high level language source file to machine language conversion. **(06 Marks)**

b. Compare DFG and CDFG models with an example. **(06 Marks)**

c. With the help of FSM model, explain the design and operation of automatic seat belt warning system. **(08 Marks)**

Module-5

9 a. Define the term operating system, with a neat diagram, explain the operating system architecture. **(07 Marks)**

b. Define process, explain in detail the structure, memory organization and state transitions of the process/task. **(07 Marks)**

c. Three processes with process IDs P_1, P_2, P_3 with estimated completion time 10, 5, 7 miliseconds respectively enters the ready queue together. A new process P_4 with estimated completion time 2ms enters the ready queue after 2ms. Calculate the waiting time for all the processes and the turn around time for all the processes. Also, calculate the average waiting time and turn around time. Algorithm used is SJF (Shortest Job First) based preemptive scheduling. Assume all the process contain only CPU operation and no I/O operation are involved. **(06 Marks)**

OR

10 a. Explain the concept of 'deadlock' with a neat diagram. Mention the different conditions which favors a deadlock situation. **(08 Marks)**

b. Write a block schematic of IDE environment for embedded system design and explain their functions in brief. **(08 Marks)**

c. Write a note on IAP [In Application Programming] and in system programming. **(04 Marks)**

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18EC63

Sixth Semester B.E. Degree Examination, Jan./Feb. 2023
Microwave and Antennas

Time: 3 hrs. Max. Marks: 100

Note: ***1. Answer any FIVE full questions, choosing ONE full question from each module.***
2. Use of Smith chart is permitted.

Module-1

1 a. Describe the mechanism of oscillation of Reflex Klystron. **(07 Marks)**

b. Explain different mode curve in the case of Reflex Klystron. **(06 Marks)**

c. A reflex Klystron is to be operated at frequency of 10GHz, with DC beam voltage 300Volt repeller space 0.1cm for $1\frac{3}{4}$ mode. Calculate $P_{RF\ max}$ and corresponding repeller voltage for a beam current 20mA. **(07 Marks)**

OR

2 a. Explain with neat diagram of microwave system. **(06 Marks)**

b. Derive transmission line equation in voltage and current forms. **(07 Marks)**

c. Explain salient features of Smith chart. **(07 Marks)**

Module-2

3 a. What is reciprocal network? For a reciprocal microwave N – port network prove that the Z and Y matrices are symmetrical. **(07 Marks)**

b. Explain S – matrix representation of multiport network. **(07 Marks)**

c. State and prove the following properties of S – parameters.
i) Symmetry property for reciprocal network
ii) Unitary property for a lossless junction. **(06 Marks)**

OR

4 a. Explain with a neat sketch a precision type variable attenuator. **(07 Marks)**

b. Explain with diagram a phase shifter. **(06 Marks)**

c. Explain magic tee and derive the S-matrix and mention its applications. **(07 Marks)**

Module-3

5 a. Derive the characteristic impedance of micro-strip line. **(07 Marks)**

b. Derive the characteristic impedance of shielded strip line. **(07 Marks)**

c. A certain micro strip line has the following parameters :
$\varepsilon_r = 5.23$; h = 7 mils ; t = 2.8 mils and w = 10 mils.
Calculate the characteristic impedance Z_0 of the line. **(06 Marks)**

OR

6 a. Explain the basic Antenna parameters. **(07 Marks)**

b. Explain briefly :
i) Radiation intensity
ii) Beam efficiency
iii) Directivity and Gain. **(07 Marks)**

c. Explain the radio communication link and derive Frii's transmission formula. **(06 Marks)**

Module-4

7 a. Explain and derive the arrays of two isotropic point sources of same amplitude and phase. **(10 Marks)**

b. Explain with neat diagram linear arrays of 'n' isotropic point sources of equal amplitude and spacing. **(10 Marks)**

OR

8 a. Explain the electric and magnetic fields of short dipole. **(07 Marks)**

b. Explain the radiation resistance of short electric dipole. **(07 Marks)**

c. Explain the linear antenna. Also write supporting equations for E and H field. **(06 Marks)**

Module-5

9 a. Explain with relevant equations the small loop antenna. **(06 Marks)**

b. Explain the directivity of circular loop antenna with uniform current. **(07 Marks)**

c. With supporting equations explain rectangular Horn Antenna. **(07 Marks)**

OR

10 a. Explain with neat diagram of Helix Geometry and Helix modes. **(07 Marks)**

b. Explain practical design consideration for the mono-filar axial mode Helical antenna. **(07 Marks)**

c. Explain briefly :
i) Yagi – Uda array
ii) Parabolic reflector. **(06 Marks)**

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CBCS SCHEME

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Sixth Semester B.E. Degree Examination, Jan./Feb. 2023
Digital System Design using Verilogy

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Explain with illustration, a simple design methodology followed in IC industries. **(10 Marks)**

b. Develop a verilog model for a 7-segment decoder. Include an additional input, blank, that overrides the BCD input and causes all segments not to be lit. **(10 Marks)**

OR

2 a. Develop a data path to perform complex multiplication of two complex number whose real and imaginary parts are represented as signed fixed point numbers with 4-pre binary points and 12 – post binary points. Real and imaginary parts of the product are represented with 8 pre–binary points and 24 post–binary points. Area is the main constraint. **(10 Marks)**

b. Design an encoder for the burglar alarm that has sensors for each of the 8 zones as a priority encoder with zone 1 having highest priority down to zone 8 having lowest priority. **(10 Marks)**

Module-2

3 a. Explain Bidirectional tri state data connections. Design a 64k × 8 bit composite memory using four 16K × 8 bit components using bidirectional tri state data connections. **(12 Marks)**

b. Explain flow through and pipelined SSRAM with the help of timing diagram. **(08 Marks)**

OR

4 a. What is common cause of soft errors in DRAMs? Compute the 12-bit ECC word corresponding to the 8-bit data word 01100001. **(12 Marks)**

b. Develop a verilog model of a dual-port 4K × 16 bit flow through SSRAM. One port allows data to be written and read, while the other allows data to be read. **(08 Marks)**

Module-3

5 a. Write and explain the internal organization of a CPLD. **(10 Marks)**

b. Explain differential signaling in detail. How does differential signaling improve noise immunity? **(10 Marks)**

OR

6 a. Write and explain internal organization of FPGA. **(10 Marks)**

b. Explain internal circuit organization and output logic macro cell of GAL22V10 component (Generic Array Logic) with neat sketch. **(10 Marks)**

Module-4

7 a. Construct flash ADC and successive approximation ADC with a help of necessary diagrams. **(12 Marks)**

b. Explain the following serial interface standards for connecting I/O devices :
i) I^2C ii) USB iii) RS – 232 iv) Fire wire. **(08 Marks)**

OR

8 a. With a neat diagram, explain R – string DAC and R/2R ladder DAC. **(12 Marks)**

b. Develop a controller for a key pad matrix and show how to connect controller to a Gumnet core use output port address 4 for the matrix row output register and input port address 4 for the matrix column input register. Develop the verilog model for the controller. **(08 Marks)**

Module-5

9 a. Explain the hardware and software co-design flow, with neat sketch. **(08 Marks)**

b. Explain Built – In – Self Test (BIST) techniques. **(12 Marks)**

OR

10 a. Outline the terms scan design and boundary scan with neat sketch. **(12 Marks)**

b. Briefly describe techniques used in power optimization. **(08 Marks)**

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CBCS SCHEME

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18EC71

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
Computer Networks

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. What is Physical Topology? With a neat diagram, explain the various types of physical topologies available in computer networks. **(10 Marks)**

b. With a neat diagram, explain the significance of layers in TCP/IP protocol suite. **(10 Marks)**

OR

2 a. Explain LAN and WAN with the help of neat diagrams. **(06 Marks)**

b. With a neat diagram, explain the five components of Data Communication. **(06 Marks)**

c. Explain encapsulation and decapsulation in TCP/IP model with the help of a neat diagram. **(08 Marks)**

Module-2

3 a. What is an ARP? Explain the operation of ARP and its packet format with suitable diagrams. **(10 Marks)**

b. Explain stop and wait protocol with a neat FSM diagram. Also explain how sequence and acknowledge numbers prevent duplication of frames with necessary diagrams. **(10 Marks)**

OR

4 a. A slotted ALOHA network transmits 200 bit frames using a shared channel with a 200 kbps bandwidth. Find the throughput if the system produces
(i) 1000 frames per second (ii) 500 frames per second (iii) 250 frames per second? **(06 Marks)**

b. Explain CSMA/CA protocol with a flow diagram. **(08 Marks)**

c. Explain the Ethernet Frame format of standard Ethernet. **(06 Marks)**

Module-3

5 a. Explain with a neat diagram, the virtual circuit packet switched network and its various phases of operation. **(10 Marks)**

b. With a neat diagram explain IPv4 Datagram format. **(10 Marks)**

OR

6 a. Explain with an example, the Distance Vector Routing algorithm. **(10 Marks)**

b. Explain with an example, Link State Routing and also apply Dijkstra algorithm to find least cost path tree. **(10 Marks)**

Module-4

7 a. Explain connectionless and connection oriented protocols in transport layer. **(10 Marks)**

b. With a neat diagram, explain state transition diagram of TCP. **(10 Marks)**

OR

8 a. Explain Go-Back-N protocol along with sliding window diagrams. **(10 Marks)**

b. Explain TCP connection establishment using three way hand shaking. **(10 Marks)**

Module-5

9 a. Explain World Wide Web and Web documents with necessary diagrams. **(10 Marks)**

b. Explain the Architecture of Electronic mail with a neat diagram. **(10 Marks)**

OR

10 a. Explain with an example, the working of Hyper Text Transfer Protocol. **(10 Marks)**

b. What is Name-address resolution? With a neat diagram, explain the various types of resolution that are available. **(10 Marks)**

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CBCS SCHEME

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18EC72

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
VLSI Design

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. With neat graph define Moore's law. Explain the history of integrated structures. **(06 Marks)**

b. Realize CMOS logic structure for the Boolean expressions :

i) $y = \overline{(a \cdot b) + (c \cdot d)}$ ii) $y = a \cdot (b + c)$. **(06 Marks)**

c. With neat diagrams, explain 3 regions of operations of nMOS transistor. **(08 Marks)**

OR

2 a. List the any three non ideal features of transistors. Explain each in detail. **(06 Marks)**

b. Draw the diagram of general logic gate structure. Explain 2-input CMOS NAND gate functioning using truth table. **(06 Marks)**

c. Draw schematic diagram of CMOS inverter. Explain the graphical derivation of CMOS inverter DC characteristics. **(08 Marks)**

Module-2

3 a. With neat diagrams, explain the complete CMOS fabrication process. **(12 Marks)**

b. Using relevant equations explain full scaling (constant field scaling) applied to i) Channel length ii) Channel depth iii) Oxide thickness iv) Junction depth v) Supply vi) Threshold voltage vii) Doping densities N_A, N_D. **(08 Marks)**

OR

4 a. Write a short note on timing analyzer. **(06 Marks)**

b. With neat diagrams, explain the lumped representation of parasitic MOSFET capacitances. **(08 Marks)**

c. Draw and explain layout rules for transistors. **(06 Marks)**

Module-3

5 a. Explain various stages of timing optimization in VLSI design. **(08 Marks)**

b. With equations explain the calculation of inverter delay. **(06 Marks)**

c. Estimate the propagation delay t_{pd} for unit inverter driving 'm' identical unit inverters using Elmore delay. **(06 Marks)**

OR

6 a. Draw the diagram of photo masking with a negative resist and explain. **(08 Marks)**

b. What is logical effort? Explain HI-Skew inverter construction by down sizing of nMOS transistor. **(06 Marks)**

c. Explain pseudo nMOS inverter with schematic diagram and DC transfer characteristics. **(06 Marks)**

Module-4

7 a. Draw and explain the functioning of pulse generators. **(08 Marks)**

b. Explain the working of resettable flip-flops and latches. **(12 Marks)**

OR

8 a. Draw and explain the features of C^2MOS latch. **(08 Marks)**

b. With neat circuit diagrams, explain 4 transparent latches. Write the advantage and disadvantage of each. **(12 Marks)**

Module-5

9 a. Draw the diagram of 4 bit × 4 bit NOR based ROM array, explain the functioning. **(08 Marks)**

b. What is static RAM? With neat diagram explain any 3 static RAM circuits. **(12 Marks)**

OR

10 a. Write a short note on design for testability. **(06 Marks)**

b. Explain manufacturing test principles in detail. **(06 Marks)**

c. Explain the logic verification principles. **(08 Marks)**

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