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INDEXFILEQUESTIONPAPERSDEC.2023/JAN.2024 ELECTRONICS AND COMMUNICATION

18 IIIsem EC

CBCS SCHEME

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18EC32

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Define the following network terminology
i) Network element ii) Branch iii) Node iv) Mesh. **(08 Marks)**

b. Determine the voltage at node 2 in the circuit shown in Fig Q1(b) source transformation.

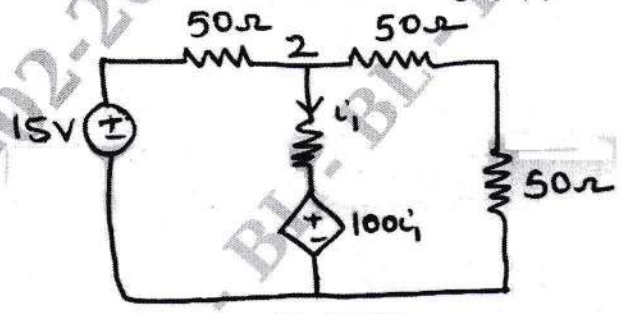

Fig Q1(b) **(06 Marks)**

c. Determine the equivalent resistance between the terminals A and B for the circuit shown in Fig Q1(c).

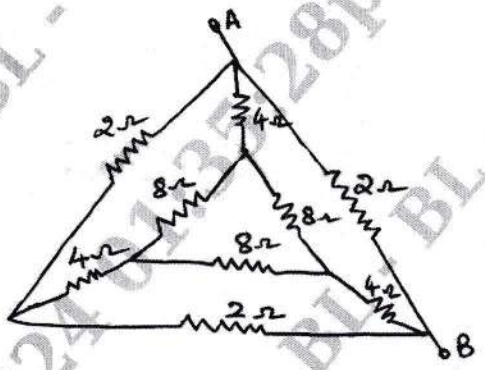

Fig Q1(c) **(06 Marks)**

OR

2 a. Obtain expressions to convert star connected impedances into equivalent delta connected impedances. **(06 Marks)**

b. Determine V_2 which results in zero current 8Ω resistor using mesh analysis for the circuit shown in Fig Q2(b)

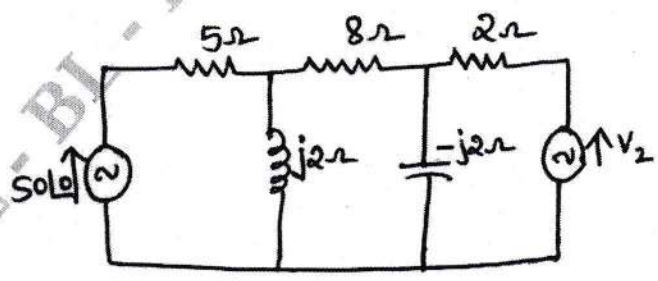

Fig Q2(b) **(07 Marks)**

c. Determine V_1, V_2, V_3 for the network shown in Fig Q2(c) using nodal analysis.

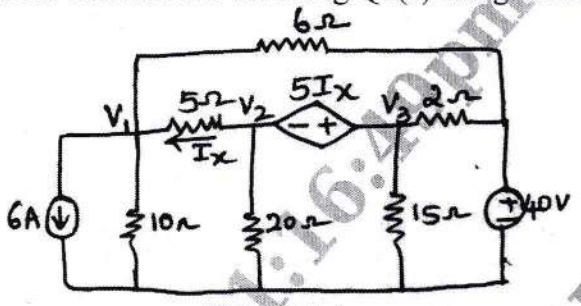

Fig Q2(c) **(07 Marks)**

Module-2

3 a. Obtain Thevenins and Nortan's equivalent circuit for the network shown in Fig Q3(a)

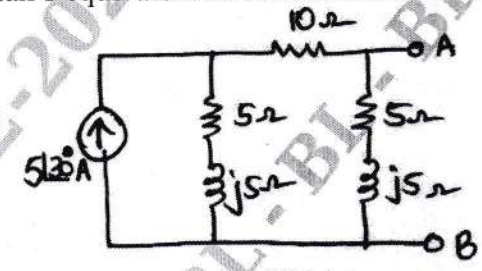

Fig Q3(a) **(08 Marks)**

b. State and explain maximum power transfer theorem. **(05 Marks)**

c. Determine the voltage V_x across 30Ω resistor using superposition theorem for the network shown in Fig Q3(c)

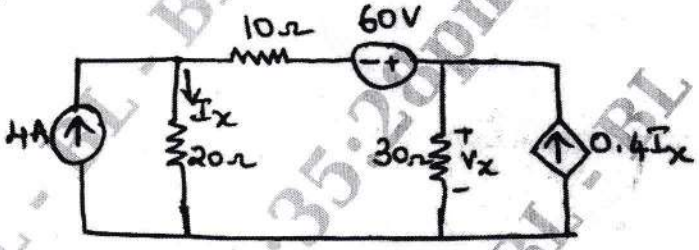

Fig Q3(c) **(07 Marks)**

OR

4 a. Find V_x using Thevenins theorem for the network shown in Fig Q4(a)

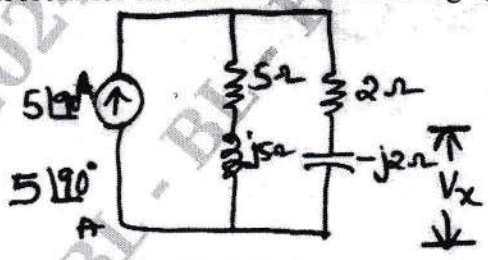

Fig Q4(a) **(06 Marks)**

b. Determine the value of R_L when maximum power is transferred across it. Also find the power transfer in the circuit. Shown in Fig Q4(b)

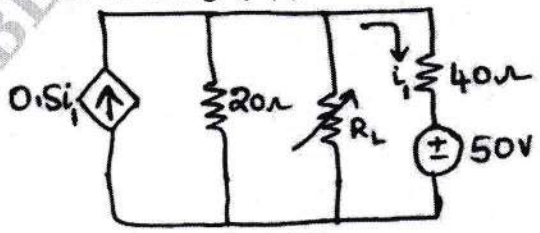

Fig Q4(b) **(08 Marks)**

c. Determine current through R_L using Nortan's theorem for the network shown in Fig Q4(c)

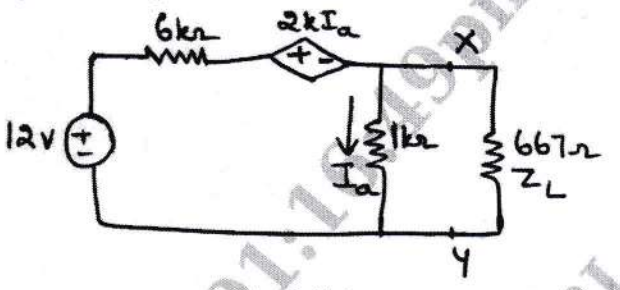

Fig Q4(c) **(06 Marks)**

Module-3

5 a. Explain the behaviour of R, L and C elements for transients. Mention their representation at the instant of switching. **(06 Marks)**

b. Determine i, $\frac{di}{dt}$, $\frac{d^2t}{dt^2}$ at $t = 0^+$ for the network shown in Fig Q5(b) when switch K is changed from position 1 to 2 at t = 0, steady state condition having reached before switching.

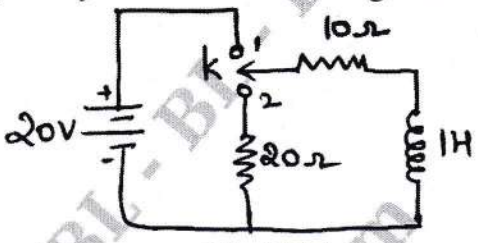

Fig Q5(b) **(07 Marks)**

c. For the network shown in Fig Q5(c), steady state is reached with switch K-open. Switch is closed at t = 0, solve for i_1, i_2, $\frac{di_1}{dt}$, $\frac{di_2}{dt}$ at $t = 0^+$.

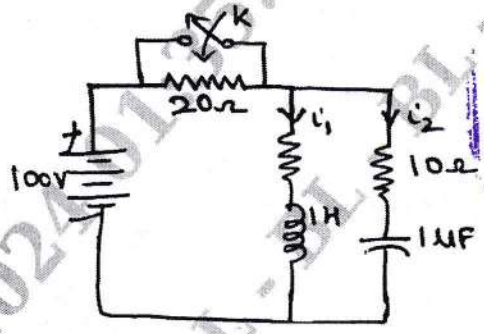

Fig Q5(c) **(07 Marks)**

OR

6 a. Derive an expression for transient response of series RC circuit for DC excitation. **(06 Marks)**

b. Determine the voltage $V_R(t)$ and $V_c(t)$ for $t \geq 0$ when switch is moved from position 1 to 2 for the network shown in Fig Q6(b)

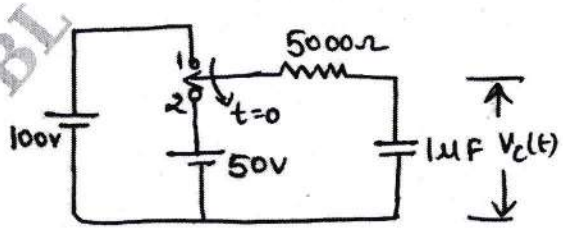

Fig Q6(b) **(08 Marks)**

c. For the network shown in Fig Q6(c), switch K is changed from 1 to 2 at t = 0, steady state having been attained in position 1. Find the values of i, $\frac{di}{dt}$ $\frac{d^2i}{dt^2}$ at t = 0.

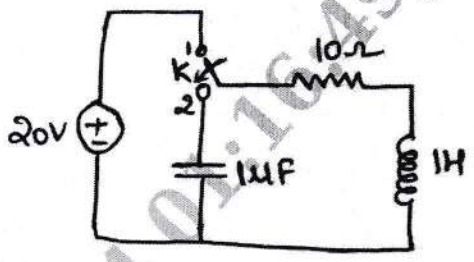

Fig Q6(c) **(06 Marks)**

Module-4

7 a. State and prove initial and final value theorem. **(06 Marks)**

b. Determine Laplace transform of the function shown in Fig Q7(b)

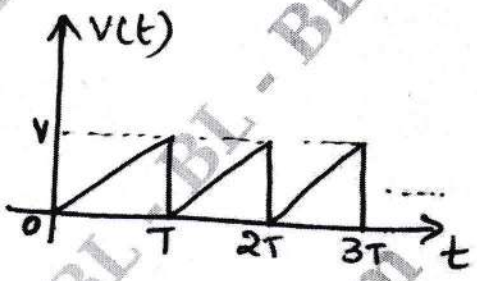

Fig Q7(b) **(06 Marks)**

c. Obtain Laplace transform of (i) δ(t) (ii) u(t) (iii) t (iv) Sinwt **(08 Marks)**

OR

8 a. Obtain Laplace transform for the waveform shown in Fig Q8(a)

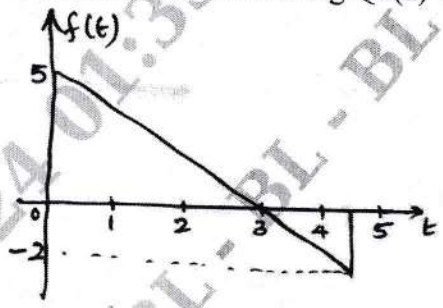

Fig Q8(a) **(08 Marks)**

b. Determine the relation between unit step and unit ramp function. **(04 Marks)**

c. Synthesize the waveform and find the Laplace transform of the waveform shown in Fig Q8(c)

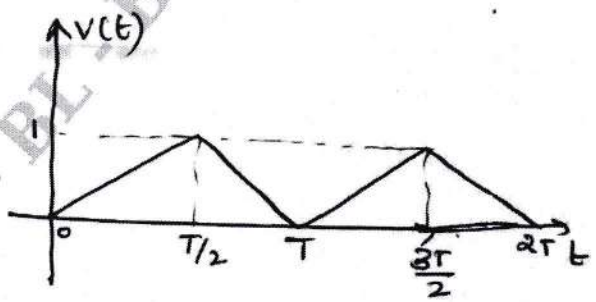

Fig Q8(c) **(08 Marks)**

Module-5

9 a. Obtain Z-parameters interms of Y-parameters. **(06 Marks)**

b. A series RLC circuit has R = 4Ω, L = 1mH, C = 10μF, calculate Q-factor, Bandwidth, resonating frequency half power frequency. **(06 Marks)**

c. Determine ABCD parameters for the network shown in Fig Q9(c)

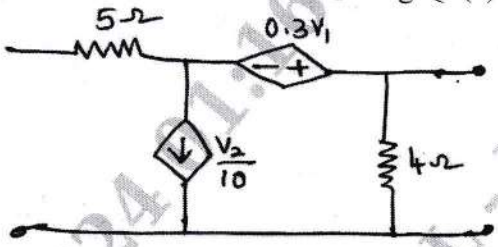

Fig Q9(c) **(08 Marks)**

OR

10 a. Derive an expression for resonant frequency of the circuit shown in Fig Q10(a)

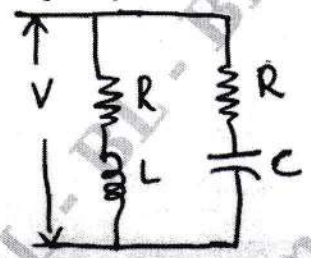

Fig Q10(a) **(06 Marks)**

b. Determine H-parameters and Y-parameters for the network shown in Fig Q10(b)

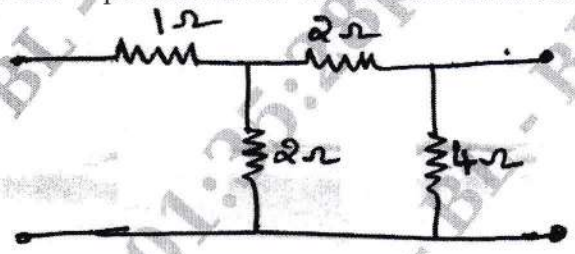

Fig Q10(b) **(08 Marks)**

c. Determine the value of R such that the circuit in Fig Q10(c) is resonant.

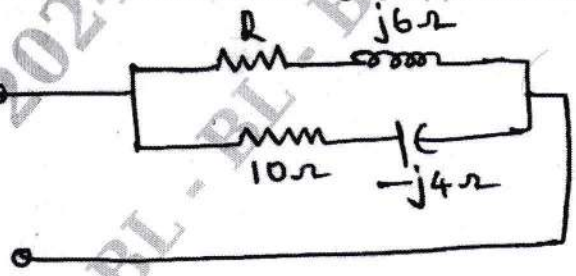

Fig Q10(c) **(08 Marks)**

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18EC33

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Electronics Devices

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Outline the classficiation of material based on conductivity and energy band diagram. **(10 Marks)**

b. Classify the intrinsic and extrinisic materials, with the help of relevant diagrams. **(10 Marks)**

OR

2 a. Define mass action law. Summarize the impurity scattering and lattice scattering. **(10 Marks)**

b. Define hall effect. With the help of neat diagram, relate an expression for current density interms of conductivity and electric field. **(10 Marks)**

Module-2

3 a. Outline the qualitative description of current flow at a junction under equilibrium condition and biased conduction. **(10 Marks)**

b. Establish the operation of a PN JUNCTION diode in reverse bias condition with a neat diagram of minority carrier distributions and Fermi level variation. **(10 Marks)**

OR

4 a. Classify the Piece – wise linear approximations of junction diode under ideal condition by considering the various conditions. **(10 Marks)**

b. Describe the working of photo detectors with a relevant diagrams. **(10 Marks)**

Module-3

5 a. Summarize the charge carrier flow in a p – n – p transistor with a diagram. **(10 Marks)**

b. Illustrate the Ebers – Moll model for a PNP transistor. **(10 Marks)**

OR

6 a. Explain how BJT acts as a switch with necessary equations and diagrams. **(10 Marks)**

b. Explain the effect of base narrowing with the neat diagram and Drift in Base Region. **(10 Marks)**

Module-4

7 a. Justify "field effect transistor is a voltage controlled current device". **(10 Marks)**

b. Explain the principle of operation of n-channel enhancement mode MOSFET with a neat diagram and equations. **(10 Marks)**

OR

8 a. Illustrate the two terminal MOS structure using energy band diagram. **(10 Marks)**

b. Outline small signal equivalent circuit of JFET with neat diagram and explain the MOS structure with the aid of parallel plate capacitor. **(10 Marks)**

Module-5

9 a. Discuss the rapid thermal processing with a schematic diagram. **(10 Marks)**

b. Explain thermal oxidation process with neat diagram. **(10 Marks)**

OR

10 a. Express the integration of other circuit elements with suitable diagrams. **(10 Marks)**

b. Explain CMOS process integration. **(10 Marks)**

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18EC34

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Define combinational circuits, POS and SOP with an example. **(06 Marks)**

b. Draw the truth table for three inputs with output high when MSB and LSB the input is high. Also write the simplified switching equation for the output and realize the logic circuit for the simplified expression using basic gates. **(06 Marks)**

c. Simplify the logic expression $Y(A, B, C, D, E) = \Sigma m(5, 7, 13, 15, 21, 24, 25, 26, 27) + d(23, 29, 31)$. Also write the logic circuit for the simplified expression using NAND gate. **(08 Marks)**

OR

2 a. Convert the following expression into its canonical form.

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

ii) $Y = AB\overline{C} + AD)$ **(06 Marks)**

b. Simplify by using K-map $Y = \pi M(0, 4, 5, 7, 8, 9, 11, 12, 13, 15)$ and obtain the logical expression in form of POS. **(06 Marks)**

c. Simplify the following Boolean function using QM method $F(A, B, C, D) = \Sigma(0, 2, 3, 7, 8, 10, 12, 13)$. **(08 Marks)**

Module-2

3 a. Design a combinational circuit to find the 9's complement of a single digit BCD number realize the logic circuit using gates. **(06 Marks)**

b. What is a multiplexer? Design a 4:1 MUX with active low enable and also write its symbol with truth table. **(08 Marks)**

c. Implement the multiple function $f_1 = \Sigma m(1, 4, 5, 7)$ and $f_2 = \pi m(2, 3, 6)$. Using IC74LS138 and external gates. Assume both f_1 and f_2 will have three inputs. **(06 Marks)**

OR

4 a. What is the need for look ahead carry generator and also draw the logic diagram of look ahead carry generator with necessary logical expression. **(08 Marks)**

b. Draw the truth table of 2 bit magnitude comparator and write the logic diagram for the same with minimum number of gates. **(06 Marks)**

c. A combinational circuit is defined by the function $f_1 = \Sigma m(3, 5, 7)$ and $f_2 = \Sigma m(4, 5, 7)$ implement the circuit with PLA having three inputs, three product terms and two outputs. **(06 Marks)**

Module-3

5 a. Explain the working at SR Latch switch debouncer and also its need. **(06 Marks)**

b. Draw the logic diagram of gated D latch using NAND gates and explain its working with truth table. **(08 Marks)**

c. Draw the output waveform for the following Latch for input waveform shown in Fig Q5(c)

Fig Q5(c) **(06 Marks)**

OR

6 a. What are the limitation of SR flip flop and explain how it can be eliminated in OK flip-flop, explain with necessary logic diagram. **(08 Marks)**

b. Draw the logic diagram of 4 bit shift register with four D flip flops and four 4 × 1 multiplexer with selection inputs SI and SO the register should operate as follows :

S_1	S_0	Operation
0	0	Hold
0	1	Compliment
1	0	Clear to 0
1	1	Load parallel data

(12 Marks)

Module-4

7 a. For the ripple counter shown in Fig Q7(a) draw the timing diagram for eight clock pulses and also indicate the value of Q_1 and Q_0 **(07 Marks)**

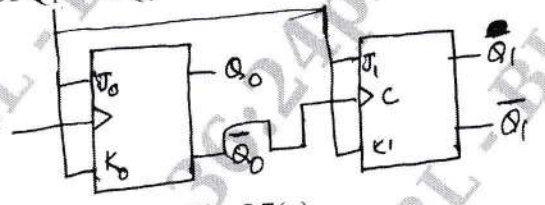

Fig Q7(a)

b. Draw the 3 bit synchronous binary up counter and explain its working with timing diagram use JK flip-flop. **(07 Marks)**

c. Explain the Moore and Melay model with necessary block diagram. **(06 Marks)**

OR

8 a. Design a synchronous MOD 6 counter using clocked D flip-flops. **(10 Marks)**

b. Design a synchronous counter using JK flip-flip to count the sequence 0, 1, 2, 4, 5, 6, 0, 1, 2. Draw state diagram and state table. **(10 Marks)**

Module-5

9 a. Design a sequence detector that produces an output 1 whenever the non overlapping sequence 101101 is detected. **(10 Marks)**

b. Explain iterative circuits use in comparator with logical diagram. **(10 Marks)**

OR

10 a. Design a logic circuit to detect the sequence 1101 using Moore model use D flip-flop. **(10 Marks)**

b. Draw the flow chart for performing the binary division operation and explain how division is performed using division algorithm given dividend = 1010 Division = 11. **(10 Marks)**

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18EC35

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. What are the basic functional units of a computer? Explain with neat sketch. **(10 Marks)**

b. Convert following Paris of numbers to 4-bit signed 2's compliment binary numbers, and add them. State whether an overflow occurs in each case.

i) +6 and +3 ii) +4 and –6 iii) –5 and –4 iv) – 8 and +1. **(08 Marks)**

c. State and explain basic performance equation. **(02 Marks)**

OR

2 a. With the aid of neat sketch explain basic operational concept of a computer. **(10 Marks)**

b. What do you mean by Big Endian and Little Endian? Explain with an example for each. **(06 Marks)**

c. What are conditional coders? Explain their significance. **(04 Marks)**

Module-2

3 a. Describe various modes of addressing with an example for each of them. **(10 Marks)**

b. Define an assembler directive. Explain any two assembler directives used in assembly language programming. **(06 Marks)**

c. Explain working of various shift instructions. **(04 Marks)**

OR

4 a. Explain the basic input/output operation performed by the processor with neat sketch. **(10 Marks)**

b. What is a stack? Explain how PUSH and POP operations are performed on a stack. **(10 Marks)**

Module-3

5 a. Describe any two methods of connecting multiple interrupting devices to the CPU. **(10 Marks)**

b. What is DMA? Explain DMA controller. **(10 Marks)**

OR

6 a. With neat diagram explain how simultaneous interrupt requests from multiple devices on single interrupting line is addressed using Daisy chain. **(10 Marks)**

b. Write a note on "Enabling and Disabling interrupts". **(10 Marks)**

Module-4

7 a. Draw the connection between memory and processor and explain how data transfer takes place between them. **(10 Marks)**

b. Draw and explain organization of SRAM and DRAM in detail. **(10 Marks)**

OR

8 a. What is a cache memory? Describe the elements of cache design. **(08 Marks)**

b. Draw and explain virtual memory organization. **(12 Marks)**

Module-5

9 a. With a neat sketch explain the single bus organization of processing unit. **(10 Marks)**

b. List and explain the control sequence for execution of the complete instruction "Add (R3), R1" for single bus architecture. **(10 Marks)**

OR

10 a. Explain in detail the organization of "hard wired control". **(10 Marks)**

b. Describe the organization of micro programmed control unit which allows conditional branching in the micro program. **(10 Marks)**

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18EC36

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
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 power electronics system with neat block diagram. **(08 Marks)**

b. List the applications of power electronics. **(04 Marks)**

c. Explain the static anode cathode characteristics of SCR with circuit diagram and V-I characteristics. **(08 Marks)**

OR

2 a. The latching current of a thyristor circuit is 50 mA. The duration of the firing pulse is 50 µsec. Given $V_s = 100$ V, R = 20Ω, L = 0.5H are connected in series.
(i) Calculate the current i(t)
(ii) Draw the variation of current i(t) with respect to time.
(iii) Will the thyristor device gets turned on? **(06 Marks)**

b. Explain different turn on methods of SCR. **(06 Marks)**

c. Explain the basic operation of UJT with circuit diagram and waveform. **(08 Marks)**

Module-2

3 a. Explain the operation of step up chopper with neat diagram and waveform. Derive the expression for output voltage. **(08 Marks)**

b. Differentiate between controlled and uncontrolled rectifier. **(04 Marks)**

c. Explain the operation of single phase half wave converter with resistive load with necessary circuit diagram and waveform. Derive the expression for average and RMS output voltage. **(08 Marks)**

OR

4 a. A single phase fully controlled bridge rectifier with R-L load to obtain a regulated DC output voltage. The RMS value of the AC voltage is 230 V at 50 Hz and the firing angle is at π/3. Load current is 4 Amps.
i) Calculate D average output voltage
ii) Active and reactive power. **(06 Marks)**

b. Explain the control strategies used to operate choppers. **(06 Marks)**

c. Explain the operation of single phase fully controlled converter with inductive load with circuit diagram and waveform. **(08 Marks)**

Module-3

5 a. Define (i) Accuracy (ii) Precision (iii) Absolute error (iv) Relative error. **(06 Marks)**

b. Explain single phase full bridge inverter with resistive load with necessary circuit diagram and waveform. **(08 Marks)**

c. Explain the errors encountered in measurement. **(06 Marks)**

OR

6 a. With neat diagram explain isolated flyback converter. **(08 Marks)**

b. Define inverter. How inverters are classified? **(04 Marks)**

c. A basic D'Arsonval movement with a deflection of 2 mA and an internal resistance of 50 Ω is available. It is to be converted into a 0 – 10 V, 0 – 100 V, 0 – 250 V multirange voltmeter. Determine the value of multiplier resistances. **(08 Marks)**

Module-4

7 a. Explain the working of Ramp type DVM with neat block diagram and waveform. **(08 Marks)**

b. Explain the working of unbalanced Wheatstone bridge and derive the expression for galvanometer current. **(08 Marks)**

c. An inductance comparison bridge is used to measure inductive impedance at a frequency of 5 Hz. The bridge constants at balance are L_3 = 10 mH, R_1 = 10 kΩ , R_2 = 40 kΩ , R_3 = 100 kΩ . Find the equivalent series circuit of an unknown impedance. **(04 Marks)**

OR

8 a. With a neat block diagram explain the working of digital frequency meter. **(08 Marks)**

b. What are the advantages of digital instruments over analog instruments? **(04 Marks)**

c. With a neat block diagram explain the working of successive approximation DVM. **(08 Marks)**

Module-5

9 a. Explain the working of resistance thermometer. Mention the advantages and disadvantages. **(08 Marks)**

b. With a neat diagram explain the construction and working of LVDT. **(08 Marks)**

c. List the factors considered while selecting the transducer. **(04 Marks)**

OR

10 a. Explain instrumentation amplifier with transducer bridge. Derive the expression for output voltage. **(10 Marks)**

b. Explain : (i) Analog Weight Scale (ii) PLC Structure and Operation. **(10 Marks)**

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CBCS SCHEME

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18MATDIP31

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Express $\sqrt{8}+4i$ in the polar form and hence find its modulus and amplitude. **(08 Marks)**

b. Find the real part of $\dfrac{1}{1+\cos\theta-i\sin\theta}$ **(06 Marks)**

c. Show that $(1+\cos\theta+i\sin\theta)^n+(1+\cos\theta-i\sin\theta)^n=2^{n+1}\cos^n\left(\dfrac{\theta}{2}\right)\cos\left(\dfrac{n\theta}{2}\right)$ **(06 Marks)**

OR

2 a. If $\vec{A}=\hat{i}+2\hat{j}+3\hat{k}$, $\vec{B}=-\hat{i}+2\hat{j}+\hat{k}$ and $\vec{C}=3\hat{i}+\hat{j}$, find p such that $\vec{A}+p\vec{B}$ is perpendicular to $\vec{C}$. **(08 Marks)**

b. Find the area of the parallelogram whose adjacent sides are the vectors $\vec{A}=2\hat{i}+4\hat{j}-5\hat{k}$ and $\vec{B}=\hat{i}+2\hat{j}+3\hat{k}$. **(06 Marks)**

c. If $\vec{A}=\hat{i}+2\hat{j}-3\hat{k}$ and $\vec{B}=3\hat{i}-\hat{j}+2\hat{k}$ then show that $\vec{A}+\vec{B}$ and $\vec{A}-\vec{B}$ are orthogonal. **(06 Marks)**

Module-2

3 a. Obtain the Maclaurin's series expansion of log(sec x) upto the term containing x^3. **(08 Marks)**

b. Using Euler's theorem, prove that $xu_x+yu_y=\dfrac{5}{2}u$ where $u=\dfrac{x^3+y^3}{\sqrt{x+y}}$ **(06 Marks)**

c. If u = f(x – y, y – z, z – x), then show that $u_x+u_y+u_z=0$. **(06 Marks)**

OR

4 a. Prove that

$\sqrt{1+\sin 2x}=1+x-\dfrac{x^2}{2}-\dfrac{x^3}{6}+\dfrac{x^4}{24}+\ldots\ldots$ by using Maclaurin's series. **(08 Marks)**

b. If $u=\sin^{-1}\left\{\dfrac{x^2y^2}{x+y}\right\}$, then show that $xu_x+yu_y=3\tan u$, by using Euler's theorem. **(06 Marks)**

c. If $u=2xy$, $v=x^2-y^2$ and $x=r\cos\theta$, $y=r\sin\theta$, find $\dfrac{\partial(u,v)}{\partial(r,\theta)}$. **(06 Marks)**

Module-3

5 a. A particle moves along the curve $x=1-t^3$, $y=1+t^2$, $z=2t-5$ where t is time. Find the components of velocity and acceleration at t = 1 in the direction $2\hat{i}+\hat{j}+2\hat{k}$ **(08 Marks)**

b. Find the unit normal to the surface $xy^3z^2=4$ at $(-1,-1,2)$ **(06 Marks)**

c. Show that $\vec{F}=(x+y+z)\hat{i}+(x+2y-z)\hat{j}+(x-y+2z)\hat{k}$ is irrotational. **(06 Marks)**

OR

6 a. Find $\nabla\cdot\vec{F}$ and $\nabla\times\vec{F}$ where $\vec{F}=\nabla(x^3+y^3+z^3-3xyz)$ **(08 Marks)**

b. If $\vec{F}=(x+y+1)\hat{i}+\hat{j}-(x+y)\hat{k}$, then show that $\vec{F}\cdot \text{curl}\,\vec{F}=0$. **(06 Marks)**

c. Find the value of a such that $\vec{F}=(x+3y)\hat{i}+(y-2z)\hat{j}+(x+az)\hat{k}$ is solenoidal. **(06 Marks)**

Module-4

7 a. Evaluate

$$\int_0^{\pi/2}\sin^5 x\,dx$$ **(08 Marks)**

b. Evaluate $\displaystyle\int_0^{\infty}\frac{x^4}{(1+x^2)^4}\,dx$ **(06 Marks)**

c. Evaluate $\displaystyle\iint_R (x^2+y^2)\,dx\,dy$ where R is the region bounded by y = x and $y=x^2$. **(06 Marks)**

OR

8 a. Evaluate

$$\int_0^{\pi/2}\cos^6 x\,dx$$ **(08 Marks)**

b. Evaluate $\displaystyle\int_0^{a} x\sqrt{ax-x^2}\,dx$ **(06 Marks)**

c. Evaluate $\displaystyle\int_0^a\int_0^b\int_0^c (x+y+z)\,dx\,dy\,dz$ **(06 Marks)**

Module-5

9 a. Solve : $y(2x-y+1)dx+x(3x-4y+3)dy=0$ **(08 Marks)**

b. Solve : $\dfrac{dx}{dy}+\dfrac{y\cos x+\sin y+y}{\sin x+x\cos y+x}=0$ **(06 Marks)**

c. Solve : $\dfrac{dx}{dy}+\dfrac{2y}{x}=y^2x$ **(06 Marks)**

OR

10 a. Solve : $\dfrac{dy}{dx}+\dfrac{y}{x}=y^2x$ **(08 Marks)**

b. Solve : $(5x^4+3x^2y^2-2xy^3)dx+(2x^3y)-3x^2y^2-5y^4)dy=0$ **(06 Marks)**

c. Solve : $\dfrac{dy}{dx}+y\cot x=\cos x$ **(06 Marks)**

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21 III sem. EC

CBCS SCHEME

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21EC33

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Basic Signal Processing

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. Write the complete solution $x = x_p + x_n$. to

$$A = \begin{bmatrix} 1 & 2 & 2 & 2 \\ 2 & 4 & 6 & 8 \\ 3 & 6 & 8 & 10 \end{bmatrix}.$$ **(10 Marks)**

b. Define the four fundamental vector spaces and find the Dimension and basis for four fundamental subspaces for :

$$A = \begin{bmatrix} 1 & 2 & 3 & 5 \\ 2 & 4 & 8 & 12 \\ 3 & 6 & 7 & 13 \end{bmatrix}.$$ **(10 Marks)**

OR

2 a. Illustrate the transformation of the plane that comes from four matrices and list the transformations T(x) that are not possible with Ax. **(10 Marks)**

b. Compute A^TA and their eigen values and unit eigen vectors for V and u. Then check $AV = u\Sigma$.

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

Module-2

3 a. What is an orthogonal matrix. Apply the gram Schmidt process to

$$a = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \quad b = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix} \quad c = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$ and write the result in the form of A = QR. **(10 Marks)**

b. Find the projection of b onto the column space of A.

$$A = \begin{bmatrix} 1 & 1 \\ 1 & -1 \\ -2 & 4 \end{bmatrix} \quad b = \begin{bmatrix} 1 \\ 2 \\ 7 \end{bmatrix}.$$ **(10 Marks)**

15

OR

4 a. Find eigen values and eigen vectors for the matrix. A can the matrix be diagonalized.

$$A=\begin{bmatrix}1 & 6 & 1\\ 1 & 2 & 0\\ 0 & 0 & 3\end{bmatrix}.$$ **(10 Marks)**

b. i) What is a positive definite matrix? Mention the methods of testing positive definiteness. **(04 Marks)**

ii) Decide for or against the positive definiteness of

$$A=\begin{bmatrix}2 & -1 & -1\\ -1 & 2 & -1\\ -1 & -1 & 2\end{bmatrix}\quad B=\begin{bmatrix}2 & -1 & -1\\ -1 & 2 & 1\\ -1 & 1 & 2\end{bmatrix}.$$ **(06 Marks)**

Module-3

5 a. Define a signal. List the elementary signals. Differentiate between even and odd signals, energy and power signals. **(10 Marks)**

b. Sketch the even the odd part of the signals shown in Fig.Q5(b)(i) and 5(b)(ii).

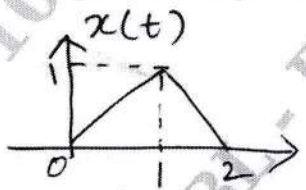


Fig.Q5(b)(i)

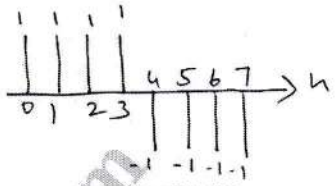


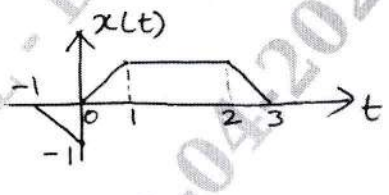
Fig.Q5(b)(ii) **(08 Marks)**

c. Determine whether the following signal is periodic or not. If periodic find the fundamental period $x(n)=\cos\left(\frac{n\pi}{5}\right)\sin\left(\frac{n\pi}{3}\right)$. **(02 Marks)**

OR

6 a. Determine whether the following systems are memoryless, causal time invariant, linear and stable. i) $y(n)=nx(n)$ ii) $y(t)=x(t/2)$. **(08 Marks)**

b. For the signal x(t) and y(t) shown in Fig.6(a) sketch the following signals :
i) $x(t+1)y(t-2)$ ii) $x(t)y(t-1)$



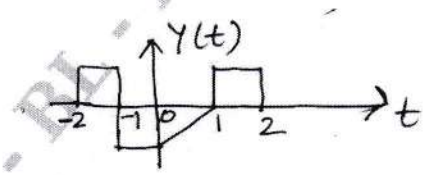


Fig.Q6(b) **(08 Marks)**

c. Sketch the waveform of the signal : $x(t)=u(t+1)-2u(t)+u(t-1)$. **(04 Marks)**

Module-4

7 a. Compute the following convolution :

i) $y(t)=e^{-2}u(t-2)*\{u(t-2)-u(t-12)\}$

ii) $y(n)=\alpha^n\{u(n)-u(n-6)\}*2\{u(n)-4(n-15)\}$. **(14 Marks)**

b. Prove the following :

i) $x(t)*\delta(t-t_0)=x(t-t_0)$

ii) $x(n)*u(n)=\sum_{k=-\infty}^{n}X(k)$. **(06 Marks)**

OR

8 a. Evaluate the step response for LTI system represented by the following impulse response :
i) $h(t) = u(t+1) - u(t-1)$
ii) $h(n) = (1/2)^n u(n)$. **(08 Marks)**

b. Determine whether the following system defined by their impulse response are causes memoryless and stable.
i) $h(t) = e^{-2t}u(t-1)$
ii) $h(n) = 2u(n) - 2u(n-5)$. **(08 Marks)**

c. A system consists of several subsystems connected as shown in Fig.Q8(c). Find the operator H relating x(t) to y(t) for the following subsystem operators.
H1 : $Y_1(t) = X_1(t)X_1(t-1)$
H2 : $Y_2(t) = |X_2(t)|$
H3 : $Y_3(t) = 1 + 2\,X_3(t)$
H4 : $Y_4(t) = \cos(X_4(t))$.

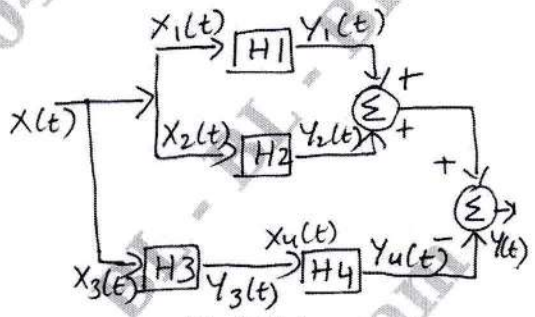


Fig.Q8(c) **(04 Marks)**

Module-5

9 a. Describe the properties of region of convergence and sketch the ROL of two sided, ,right sided and lift sided sequence. **(08 Marks)**

b. Find Z – tranform of the following and specify its ROC

$$x(n) = \sin\left(\pi/4\, n - \pi/2\right)u(n-2)$$

$$x(n) = \left(2/3\right)^n u(n) * 2^n u(-n-3).$$ **(08 Marks)**

c. Find inverse Z-transform if $X(z) = \dfrac{\left(1/4\right)z^{-1}}{\left(1 - 1/2\, z^{-1}\right)\left(1 - 1/4\, z^{-1}\right)}$. **(04 Marks)**

OR

10 a. Describe the transfer function and the impulse response for the causal LTI system described by the differential equation :

$$y(n) - \frac{1}{4}y(n-1) - \frac{3}{8}y(n-2) = -x(n) + 2x(n-1).$$ **(10 Marks)**

b. Determine the impulse response of the following transfer function if :
i) The system is causal
ii) The system is stable
iii) The system is stable and causal at the same time : $H(z) = \dfrac{3z^{+2} - z}{(z-2)\left(z + \frac{1}{2}\right)}$. **(10 Marks)**

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21EC34

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Analog Electronic 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 biasing of BJT by collector to base feedback resistor for a CE amplifier. **(08 Marks)**

b. A BJT having $\beta = 100$ is biased at a DC collector current of 1 mA. Find the value of g_m, r_e, r_π at the bias point. Assume $V_T = \frac{1}{40}V$. **(04 Marks)**

c. Draw the small signal equivalent circuit model for MOSFET and obtain the expression for voltage gain. **(08 Marks)**

OR

2 a. Explain biasing of MOSFET using drain to gate feedback resistor. **(06 Marks)**

b. What is transconductance of a MOSFET and mention the three different expression used to calculate the g_m. **(06 Marks)**

c. For the circuit shown in Fig. Q2 (c), find the required value of V_{GS} to establish a dc bias current $I_D = 0.5$ mA. Device parameters are $V_t = 1$ V, $K_n' \frac{\omega}{L} = 1$ mA/V^2 and $\lambda = 0$. What is the percentage change in I_D obtained when the transistor is replaced with another having $V_t = 1.5$ V. **(08 Marks)**

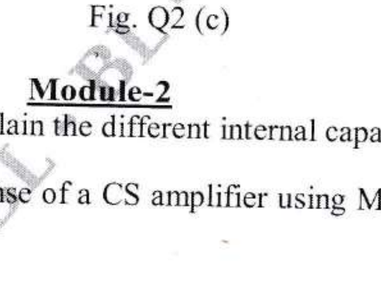

Fig. Q2 (c)

Module-2

3 a. With mathematical equations, explain the different internal capacitances in the MOSFET. **(10 Marks)**

b. Explain the high frequency response of a CS amplifier using MOSFET and derive its upper cut off frequency. **(10 Marks)**

OR

4 a. Draw the circuit of a RC phase shift oscillator using MOSFET and explain the working. **(06 Marks)**

b. A 2 MHz quartz crystal is specified to have L = 0.52 H, C_S = 0.012 PF, C_P = 4 PF and R = 120 Ω. Find f_S, f_P. **(04 Marks)**

c. Derive the expression of R_{in}, R_O, A_{VO} and A_V using T model for the common source amplifier with a source resistance circuit. **(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-3

5 a. What are the properties of negative feedback and explain it briefly. **(10 Marks)**

b. What are the topologies of basic feedback circuit? **(04 Marks)**

c. For the block diagram, shown in Fig. Q5 (c), a signal of 1 V from the source results in a difference signal of 10 mV being provided to the amplifier (A) and 10 V applied to the load. For this arrangement identify the value of A and β that apply. **(06 Marks)**

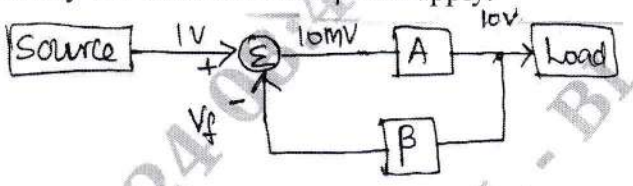

Fig. Q5 (c)

OR

6 a. Draw the circuit of a transformer coupled class-A power amplifier. Prove that the maximum conversion efficiency is 50%. **(08 Marks)**

b. What is output stage and discuss the classification of output stages based on the collector current? **(06 Marks)**

c. Neatly draw the schematic diagram of class C tuned amplifier and discuss the input and output waveforms at the collector terminal. **(06 Marks)**

Module-4

7 a. Derive the expression of output voltage and explain the operation of 4-bit DAC using R-2R circuit. **(10 Marks)**

b. What is meant by precision rectification? Explain with a neat circuit diagram, the working of a small signal half wave precision rectifier using Op-Amp. **(10 Marks)**

OR

8 a. With the help of a neat circuit diagram and relevant waveforms, explain the working of astable multivibrator circuit operation using 555 timer IC. Derive expression for T_{ON}, T_{OFF} and T. **(10 Marks)**

b. Explain the working of a second order lowpass butterworth filter. Write the design equations. Design the circuit for cut off frequency of 1 kHz. **(10 Marks)**

Module-5

9 a. With the help of the static V-I characteristics, explainthe three modes of operation of the thyristor. **(10 Marks)**

b. Explain the working of a UJT firing circuit using SCR with necessary circuit diagram and waveforms. **(10 Marks)**

OR

10 a. Discuss various power converter circuits with necessary sketches and applications of each. **(08 Marks)**

b. List different turn on methods, explain all in brief. **(08 Marks)**

c. Enumerate the applications of power electronics. **(04 Marks)**

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CBCS SCHEME

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21MAT31

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Transform Calculus Fourier Series & 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) $e^{-3t}\sin 5t.\cos 3t$ (ii) $\frac{e^{at}-e^{bt}}{t}$. **(06 Marks)**

b. If a periodic function of period 'a' is defined by $f(t)=\begin{cases} E, & \text{for } 0<t<\frac{a}{2} \\ -E, & \text{for } \frac{a}{2}<t<a \end{cases}$ then show that $L\{f(t)\}=\frac{E}{S}\tanh\left(\frac{as}{4}\right)$. **(07 Marks)**

c. Using convolution theorem find the inverse Laplace transform of $\frac{s}{(s+2)(s^2+9)}$. **(07 Marks)**

OR

2 a. Express the function $f(t)=\begin{cases} \cos t & \text{for } 0<t<\pi \\ \cos 2t & \text{for } \pi<t<2\pi \\ \cos 3t & t>2\pi \end{cases}$ interms of unit step function and hence find its Laplace transform. **(07 Marks)**

b. Find the inverse laplace transform of $\frac{2s^2-6s+5}{s^3-6s^2+11s-6}$. **(06 Marks)**

c. Solve the differential equation $\frac{d^2y}{dt^2}+4\frac{dy}{dt}+4y=e^{-t}$ with $y(0)=$ $y'(0)=0$ by using Laplace transform. **(07 Marks)**

Module-2

3 a. Find a Fourier series to represent $f(x)=|x|$ in $-\pi\le x\le\pi$. **(06 Marks)**

b. Obtain the half-range cosine series for $f(x)=x\sin x$ in $(0,\pi)$ and hence show that $\frac{\pi-2}{4}=\frac{1}{1.3}-\frac{1}{3.5}+\frac{1}{5.7}-.....\infty$ **(07 Marks)**

c. Express y as a Fourier series up to second harmonics for the following data :

x:	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π
y:	1	1.4	1.9	1.7	1.5	1.2	1.0

(07 Marks)

OR

4 a. Obtain the Fourier series expansion for the function, $f(x) = 2x - x^2$ in (0, 2). **(06 Marks)**

b. Find the half range sine series for the function, $f(x) = \begin{cases} \frac{1}{4} - x & \text{for } 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \text{for } \frac{1}{2} < x < 1 \end{cases}$ **(07 Marks)**

c. The following table gives the variation of periodic current over period :

t sec :	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$	T
A (amp) :	1.98	1.30	1.05	1.30	−0.88	−0.25	1.98

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

Module-3

5 a. Find the Fourier transform of the function $f(x) = \begin{cases} 1 - x^2 & \text{for } |x| \le 1 \\ 0 & \text{for } |x| > 1 \end{cases}$. Hence evaluate $\int_0^\infty \left(\frac{x\cos x - \sin x}{x^3} \right) dx$. **(06 Marks)**

b. Find the Fourier sine and cosine transform of $f(x) = \begin{cases} x & \text{if } 0 < x < 1 \\ 2 - x & \text{if } 1 < x < 2 \\ 0 & \text{otherwise} \end{cases}$. **(07 Marks)**

c. Find the z-transform of $\cosh\left(n\frac{\pi}{2} + \theta \right)$. **(07 Marks)**

OR

6 a. Find the Fourier sine transform of $f(x) = e^{-ax}$, a>0. **(06 Marks)**

b. Find the inverse z transform of $\frac{18z^2}{(2z-1)(4z+1)}$. **(07 Marks)**

c. Solve the difference equation $u_{n+2} + 6u_{n+1} + 9u_n = z^n$ with $u_0 = u_1 = 0$ using z-transform. **(07 Marks)**

Module-4

7 a. Classify the following partial differential equations :

(i) $\frac{\partial^2 u}{\partial x^2} + 4\frac{\partial^2 u}{\partial x \partial y} + 4\frac{\partial^2 u}{\partial y^2} - \frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$.

(ii) $x^2\frac{\partial^2 u}{\partial x^2} + (1 - y^2)\frac{\partial^2 u}{\partial y^2} = 0$, $-\infty < x < \infty$, $-1 < y < 1$.

(iii) $(1 + x^2)\frac{\partial^2 u}{\partial x^2} + (5 + 2x^2)\frac{\partial^2 u}{\partial x \partial t} + (4 + x^2)\frac{\partial^2 u}{\partial t^2} = 0$.

(iv) $(x + 1)\frac{\partial^2 u}{\partial x^2} - 2(x + 2)\frac{\partial^2 u}{\partial x \partial y} + (x + 3)\frac{\partial^2 u}{\partial y^2} = 0$. **(10 Marks)**

b. Evaluate the values at the mesh points for the equation $u_{tt} = 16u_{xx}$ taking h = 1 upto t = 1.25. The boundary conditions are u(0, t) = u(5, t) = 0 and the initial conditions are $u(x, 0) = x^2(5 - x)$ and $u_t(x, 0) = 0$. **(10 Marks)**

OR

8 a. Using Schmidt two-level formula to solve the equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ under the conditions,

(i) $u(0, t) = u(1, t) = 0 \quad t \geq 0$

(ii) $u(x, 0) = \sin \pi x, \quad 0 < x < 1$ by taking $h = \frac{1}{4}$ and $\alpha = \frac{1}{6}$ co. **(10 Marks)**

b. Solve the two-dimensional Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ at the interior mesh points of the square region and the values of u at the mesh points on the foundary are shown in Fig.Q8 (b).

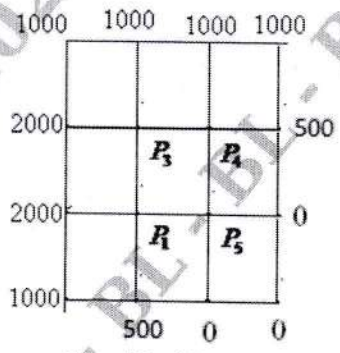

Fig. Q8 (b) **(10 Marks)**

Module-5

9 a. Using Runge-Kutta method of 4^{th} order to solve the differential equation $\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} - 4y = 0$ with $y(0) = 0.2$ and $y'(0) = 0.5$ for $x = 0.1$. Correct to four decimal places. **(07 Marks)**

b. State and prove Euler's equation. **(07 Marks)**

c. Find the extremal of the functional $I = \int_0^{\frac{\pi}{2}} (y^2 - y'^2 - 2y\sin x)dx$ under the end conditions $y(0) = 0, \; y\left(\frac{\pi}{2}\right) = 0$ **(06 Marks)**

OR

10 a. Apply Milne's method to compute $y(0.3)$. Given that $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ and $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$, $y(0.6) = 0.1762$, $y'(0) = 0$, $y'(0.2) = 0.1996$, $y'(0.4) = 0.3937$, $y'(0.6) = 0.5689$ **(07 Marks)**

b. Prove that the shortest distance between two points in a plane is a straight line. **(07 Marks)**

c. Find the extremal of the functional $I = \int_{x_1}^{x_2} (y^2 + y'^2 + 2ye^x)dx$ **(06 Marks)**

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BMATEC301/BEC/BBM301

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
AV Mathematics – III for EC/BM Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. Statistical table and handbook permitted.
4. Use of VTU Mathematics handbook is permitted.

		Module – 1	M	L	C
Q.1	a.	Obtain the Fourier series of $f(x) = \frac{\pi - x}{2}$ in $0 < x < 2\pi$. Hence deduce that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots\ldots = \frac{\pi}{4}$.	6	L2	CO1
	b.	Expand $f(x) = 2x-1$ as a Cosine half range Fourier series in $0 < x < 1$.	7	L2	CO1
	c.	Compute the First harmonics of the Fourier series of f(x). Given the table x: 0, $\frac{\pi}{3}$, $\frac{2\pi}{3}$, π, $\frac{4\pi}{3}$, $\frac{5\pi}{3}$, 2π f(x): 1.0, 1.4, 1.9, 1.7, 1.5, 1.2, 1.0	7	L3	CO1
		OR			
Q.2	a.	Obtain the Fourier series of $f(x) = \lvert x \rvert$ in $(-\ell, \ell)$.	6	L2	CO1
	b.	Obtain the Cosine half range Fourier series of $f(x) = x^2$ in $0 < x < \pi$.	7	L3	CO1
	c.	Express Y as a Fourier Cosine series upto second harmonics. Given the table : x: 0, 2, 4, 6, 8, 10, 12 y: 9.0, 18.2, 24.4, 27.8, 27.5, 22.0, 9.0	7	L3	CO1
		Module – 2			
Q.3	a.	Find the Fourier transform of $f(x) = e^{-\lvert x \rvert}$.	6	L2	CO2
	b.	Find the Fourier Cosine and Sine transform of $f(x) = e^{-\alpha x}$, $\alpha > 0$.	7	L3	CO2
	c.	i) Find a Discrete Fourier transform of the single $f = [3, 4, 5, 5]^T$. ii) Find the Inverse Discrete Fourier transform of the single obtained in part (i).	7	L3	CO2
		OR			
Q.4	a.	Find the Fourier transform of $f(x) = \begin{cases} 1 - \lvert x \rvert & \text{for } \lvert x \rvert \le 1 \\ 0 & \text{for } \lvert x \rvert > 1 \end{cases}$ and hence deduce that $\int_0^\infty \frac{\sin^2 t}{t^2}\, dt = \frac{\pi}{2}$.	6	L2	CO2

	b.	Obtain the Fourier Cosine transform of $f(x) = \begin{cases} 4x & , 0<x<1 \\ 4-x & , 1<x<4 \\ 0 & , x>4 \end{cases}$	7	L3	CO2
	c.	Solve the Integral equation $\int_0^\infty f(\theta)\cos\alpha\theta\, d\theta = \begin{cases} 1-\alpha & , 0\le\alpha\le 1 \\ 0 & , \alpha>1 \end{cases}$ and hence evaluate $\int_0^\infty \frac{\sin^2 t}{t^2} dt$.	7	L3	CO2
		Module – 3			
Q.5	a.	Find the Z – transform of i) Cos n θ ii) Sin n θ.	6	L2	CO3
	b.	Find the Inverse Z – transform of $\frac{z^2-8z}{(z-4)^2}$.	7	L3	CO3
	c.	Solve the difference equation $y_{n+2} - 4y_n = 0$. Given that $y_0 = 0$ and $y_1 = 2$.	7	L3	CO3
		OR			
Q.6	a.	Find the Z – transform of $2n + \sin\left(\frac{n\pi}{4}\right) + 1$.	6	L2	CO3
	b.	Compute the Inverse Z – transform of $\frac{3z^2+2z}{(5z-1)(5z+2)}$.	7	L3	CO3
	c.	Solve the difference equation $u_{n+2} + 6u_{n+1} + 9u_n = 2^n$ with $u_0 = u_1 = 0$, using Z – transforms.	7	L3	CO3
		Module – 4			
Q.7	a.	Solve $(D^4 - m^4)y = 0$.	6	L2	CO4
	b.	Solve $(D^2 - 2D + 1)y = \text{Sin } x + e^x$.	7	L3	CO4
	c.	Solve $x\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} = \frac{1}{x}$.	7	L3	CO4
		OR			
Q.8	a.	Solve $\frac{d^3y}{dx^3} + 8y = x^4 + 2x + 1$.	6	L2	CO4
	b.	Solve the Legendre's form of Linear equation. $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = \text{Sin } 2\,[\log(1+x0]$.	7	L3	CO4
	c.	In the LCR circuit the charge q on a plate of condenser is given by $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{C} = E \sin p\, t$. Solve the above equation.	7	L3	CO4

Module – 5

Q.9 **a.** Find a Least square straight line for the following data : **6** **L2** **CO5**

x	1	2	3	4	5	6
y	6	4	3	5	4	2

b. In a partially destroyed laboratory record, the lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y = 107$. Calculate $\bar{x}$, $\bar{y}$ and coefficient of correlation between x and y. **7** **L3** **CO5**

c. Ten competition in a beauty contest are ranked by two judges A and B in the following order. Calculate the rank correlation coefficient. **7** **L3** **CO5**

ID No. of competition	1	2	3	4	5	6	7	8	9	10
Judge A	1	6	5	10	3	2	4	9	7	8
Judge B	6	4	9	8	1	2	3	10	5	7

OR

Q.10 **a.** Fit a parabola for the data in the form $y = ax^2 + bx + c$. **6** **L2** **CO5**

x	1	2	3	4	5
y	10	12	13	16	19

b. The following table gives the heights of Father (x) and Sons (y) : **7** **L3** **CO5**

x	65	66	67	67	68	69	70	72
y	67	68	65	68	72	72	69	71

Find the lines of regression and hence calculate the co-efficient of correlation.

c. Determine the rank correlation for the following data which shows the marks obtained in two quizzes in mathematics. **7** **L3** **CO5**

Marks in first quiz X	6	5	8	8	7	6	10	4	9	7
Marks in first quiz Y	8	7	7	10	5	8	10	6	8	6

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CBCS SCHEME

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BEC302

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Digital System Design Using Verilog

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Develop a truth table of logic which takes two , 2 – bit binary numbers as its input and generate on output equal to 1, when the sum of the two numbers is odd.	7	L1	CO1
	b.	Convert the following Boolean function into : i) $f(abc) = (\bar{a} + b)(b + \bar{c})$ – Min term canonical form. ii) $f(xyz) = x + \bar{x}\,\bar{z}(y + \bar{z})$ – Max term canonical form.	7	L1	CO1
	c.	List the difference between Prime implicant and Essential prime implicant.	6	L1	CO1
		OR			
Q.2	a.	Simplify the given Boolean function using Quine Mc Cluskey Minimization Technique for the function $R = f(abcd) = \Sigma(0, 1, 2, 6, 7, 9, 10, 12) + dc(3, 5)$.	10	L1	CO1
	b.	Find the minimal sum and minimal product for the given function using K – map method for the function $R = f(abcd) = \Sigma m(0, 1, 3, 7, 8, 12) + dc(5, 10, 13, 14)$.	10	L1	CO1
		Module – 2			
Q.3	a.	List the difference between decoder and encoder and implement full adder using IC – 74138.	10	L3	CO2
	b.	What is Comparator? Design a 2 – bit digital comparator.	10	L3	CO2
		OR			
Q.4	a.	Realize the Boolean function $P = f(wxyz) = \Sigma(0, 1, 5, 6, 7, 10, 15)$ using i) 8 : 1 MUX ii) 4 : 1 MUX.	10	L2	CO2
	b.	With neat logic diagram, explain carry ahead adder.	10	L2	CO2
		Module – 3			
Q.5	a.	Explain the working of master slave JK flip flop with help of Logic diagram , Function table , Logic symbol and Timing diagram.	10	L1	CO3
	b.	Obtain the characteristic equation for : i) SR flip - flop ii) J – K – flip - flop iii) D – flip - flop iv) T – flip - flop.	10	L2	CO3

Q.6	a.	Design a Synchronous 3 – bit up counter using J K – flip - flop.	10	L4	CO3
	b.	Design a 4 – bit universal shift register using positive edge triggered D – flip - flop and 4 : 1 MUX, to operate as shown in table below :	10	L4	CO3

S_1	S_0	Register Operation
0	0	- Hold
0	1	- Shift right
1	0	- Shift left
1	1	- Parallel load operation

Module – 4

Q.7	a.	Illustrate the structure and verilog module and write a verilog code for Half – adder using structural model.	10	L3	CO4
	b.	What are different types of operators used in HDL with example?	10	L2	CO4

OR

Q.8	a.	Illustrate the structure of Data flow description with example.	10	L3	CO4
	b.	Write the syntax of conditional signal assignment statement. Write a code for 4 : 1 MUX using conditional signal statement.	10	L2	CO4

Module – 5

Q.9	a.	Write the structure of Verilog behavioral description.	6	L2	CO4
	b.	Write the syntax of IF statement with example.	7	L2	CO4
	c.	Write a code for D – Latch using Behavioral description.	7	L2	CO4

OR

Q.10	a.	Write the syntax of While loop statement with example.	10	L2	CO4
	b.	Write a verilog code of a 3 – bit ripple carry adder using Structural description method.	10	L2	CO4

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CBCS SCHEME

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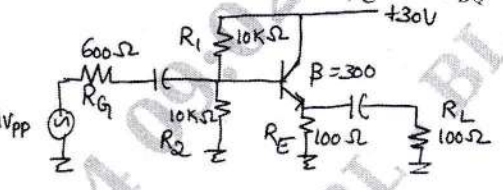
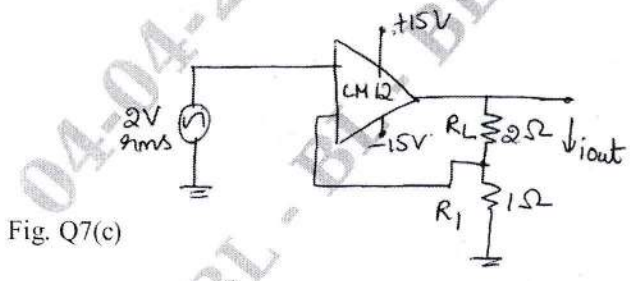
BEC303

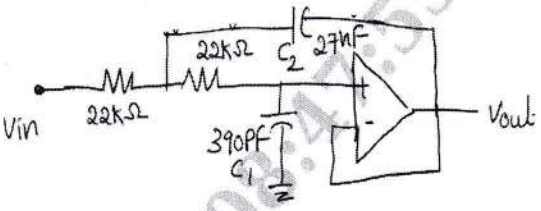
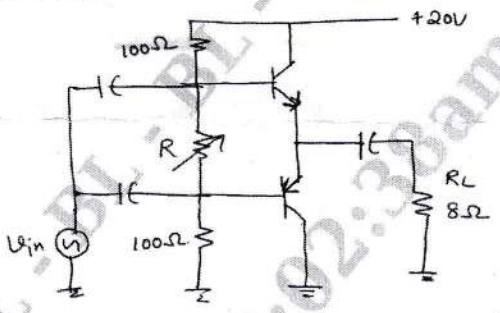
Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Electronic Principles and Circuits

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain the simplified analysis of a voltage divider bias circuit of a transistor. Also list the steps in analysis.	8	L1	CO1
	b.	Analyze a VDB Amplifier circuit with respect to DC circuit, AC - π model, AC – T model.	7	L3	CO1
	c.	Design a positive and negative biased clipper circuit.	5	L3	CO1
		OR			
Q.2	a.	With the importance of Coupling capacitor, explain the Base – Biased amplifier circuit. Support your answer with base current , collector current and collector voltage. Also draw its voltage waveforms.	10	L3	CO1
	b.	Explain the basic idea of Common – Collector (CC) amplifier. Give the mathematical relation of AC. Emitter resistance (r_e) , Voltage Gain (A_v) , Input impedance of the base ($Z_{in(base)}$) and Input impedance of the stage ($Z_{in(stage)}$).	6	L2	CO1
	c.	Calculate the output impedance for the circuit below, given $V_{BQ} = 15V$.  Fig. Q2(c)	4	L2	CO1
		Module – 2			
Q.3	a.	Biasing by fixing V_{GS} is not a good approach to bias a MOSFET. Why? Explain biasing by fixing V_G and connecting a resistance in the source for MOSFET.	8	L2	CO2
	b.	Design a fixed V_G and resistance in the source biasing circuit, to establish drain current $I_D = 0.5mA$, $V_t = 1V$, $K_n' W/K = 1mA/V^2$, $\lambda = 0$. Use power supply $V_{DD} = 15V$.	5	L3	CO2
	c.	Obtain the transfer and drain characteristics of n – channel MOSFET and calculate Drain resistance (r_d) , Mutual conductance (gm) and Amplification factor (μ).	7	L2	CO2
		OR			
Q.4	a.	Illustrate the development of T – equivalent circuit model for the MOSFET.	6	L2	CO2

	b.	Draw and explain the small signal equivalent model for Common – Source amplifier without source resistance and write the equation for R_{in} , R_{out} , A_V and G_V.	8	L2	CO2
	c.	For a Common Gate (CG) amplifier circuit , given g_m = 1mA/V , R_D = 15kΩ , R_L = 15KΩ , R_{sig} = 50Ω , R_G = 4.7μΩ. Find R_{in} , R_{out} , A_{VO} , A_V and G_V.	6	L2	CO2
		Module – 3			
Q.5	a.	Explain how an Op – amp summer circuit be configured to function as a subtractor.	5	L1	CO3
	b.	How does the design and configuration of an Op – amp R/2R DAC contribute to its accuracy and performance in converting digital signals to analog signals?	8	L2	CO3
	c.	Design and draw the frequency response of common source JFET / MOSFET amplifier.	7	L2	CO3
		OR			
Q.6	a.	Describe the working of inverting Schmitt trigger circuit. How is Schmitt trigger different from regular comparator circuit? Explain with the help of Hysteresis curve.	8	L2	CO3
	b.	Explain the working of Colpitts Oscillator with CE connection.	6	L2	CO3
	c.	Explain the Monostable operation of 555 timers.	6	L2	CO3
		Module – 4			
Q.7	a.	Explain the four types of Negative feedback amplifier.	8	L1	CO4
	b.	Explain the VCVS amplifier. Obtain its exact closed – loop voltage gain and Ideal Closed – Loop Voltage gain. Also define Gain stability , Closed loop input impedance and Closed loop output impedance of a VCVS amplifier.	8	L2	CO4
	c.	Calculate the load power , load current for the given VCIS amplifier circuit.  Fig. Q7(c)	4	L2	CO4
		OR			
Q.8	a.	Explain the Ideal response of filters.	8	L1	CO4

	b.	Determine the pole frequency , Q , Cutoff frequency and 3 – dB frequency, for the filter circuit given below : Fig. Q8(b)  Given $K_0 = 0.99$, $K_C = 1.38$, $K_3 = 1.54$.	**5**	**L2**	**CO4**
	c.	Design a Halfwave and Fullwave precision rectifier using Op – amp.	**7**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Explain class A amplifier , interns of its power gain, Output power , Power dissipation and efficiency.	**8**	**L1**	**CO5**
	b.	Explain class B push pull emitter follower amplifier. How can the crossover distortion be eliminated?	**8**	**L1**	**CO5**
	c.	Calculate the maximum transistor power dissipation and maximum output power for the given circuit. Fig. Q9(c) 	**4**	**L2**	**CO5**
		OR			
Q.10	**a.**	What is an SCR? With the help of basic SCR circuit, explain the gate triggering.	**6**	**L1**	**CO5**
	b.	Explain the phase control method of TRIAC, along with the voltage waveforms.	**7**	**L1**	**CO5**
	c.	Design a full wave controlled rectifier circuit using RC triggering.	**7**	**L3**	**CO5**

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CBCS SCHEME

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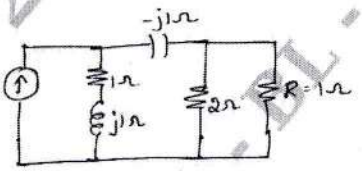
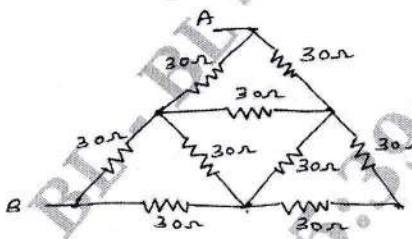
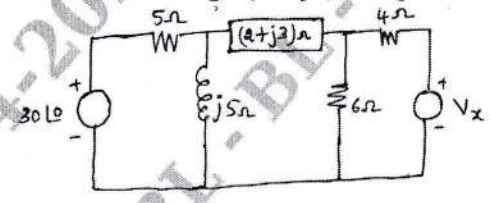
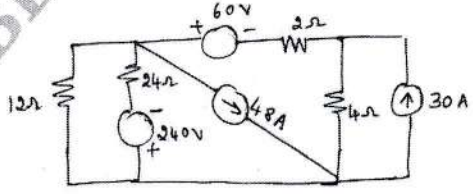
BEC304

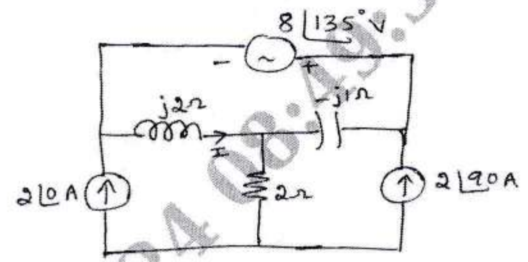
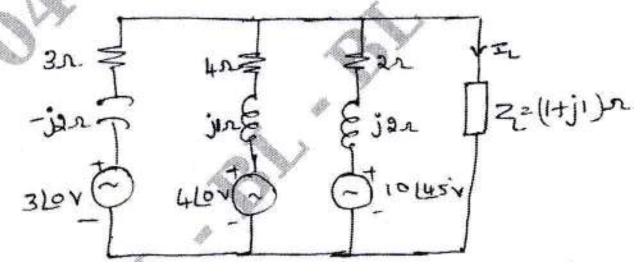
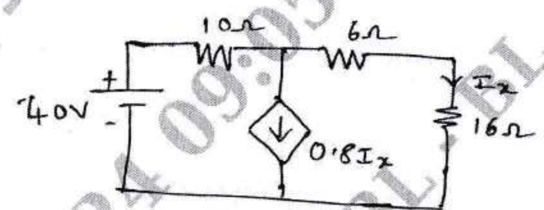
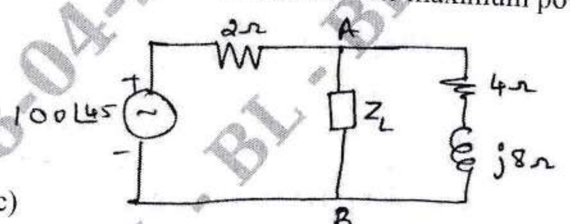
Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Network Analysis

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

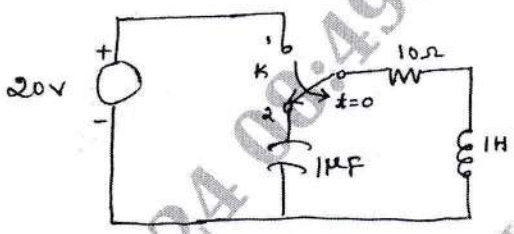
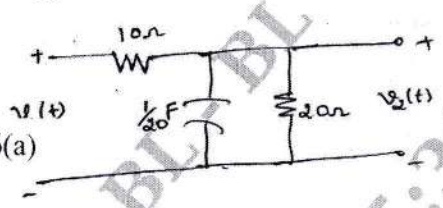
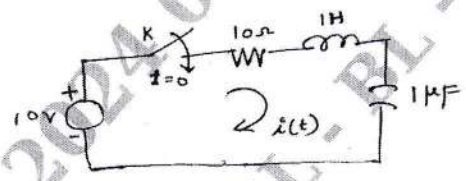
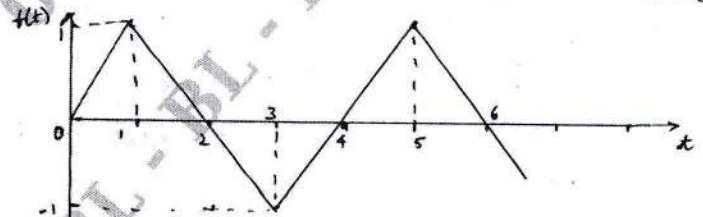
		Module – 1	M	L	C
Q.1	a.	Explain the classification of electrical networks.	8	L2	CO1
	b.	For the network shown in Fig. Q1(b), find the current through load resistor 'R' using loop analysis.  Fig. Q1(b)	6	L3	CO1
	c.	For the network shown in Fig. Q1(c), find the equivalent resistance between the terminals A – B using Star – Delta transformation.  Fig. Q1(c)	6	L3	CO1
		OR			
Q.2	a.	Derive an expression for the equivalent impedances between the terminals for Delta – Star transformation.	6	L2	CO1
	b.	Use modal analysis to find the value of voltage 'V_x' in the circuit shown in Fig. Q2(b), such that the current through $(2 + j3)\Omega$ impedance is zero.  Fig. Q2(b)	7	L3	CO1
	c.	Determine the current through 12Ω resistor shown in Fig. Q2(c), using Source Shifting / Transformation method.  Fig. Q2(c)	7	L3	CO1

Module – 2

Q. No.		Question	Marks	Level	CO
Q.3	a.	Using Superposition theorem, obtain the current 'I' for the network shown in Fig. Q3(a).  Fig. Q3(a)	10	L2	CO1
	b.	Using Millman's theorem, calculate the current through the load in the circuit shown in Fig. Q3(b).  Fig. Q3(b)	10	L3	CO2
		OR			
Q.4	a.	State and explain Norton's theorem.	6	L2	CO2
	b.	For the network shown in Fig. Q4(b), find the current through 16Ω resistor using Thevenin's theorem.  Fig. Q4(b)	7	L3	CO2
	c.	For the network shown in Fig. Q4(c), find the value of Z_L for which maximum power transfer occurs. Also find the maximum power.  Fig. Q4(c)	7	L3	CO2

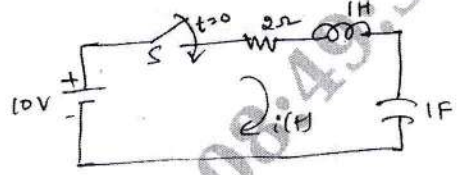
Module – 3

Q.5	a.	Explain the initial and final conditions in basic elements.	6	L2	CO3

	b.	For the circuit shown in Fig. Q5(b), the switch 'K' is changing the position from 1 to 2 at t = 0. Steady state condition has been reached at position 1. Find the value of i, $\frac{di}{dt}$, $\frac{d^2i}{dt^2}$ at $t = 0^+$.  Fig. Q5(b)	**8**	**L3**	**CO3**
	c.	Obtain an expression for transient response i(t) of a series R – L circuit when excited by DC supply.	**6**	**L2**	**CO3**
		OR			
Q.6	**a.**	In the circuit shown in Fig. Q6(a), $v_1(t) = e^{-t}$ for $t \geq 0$ and zero for all $t < 0$. If the capacitor is initially uncharged, determine the value of $v_2(t)$, $\frac{dv_2(t)}{dt}$, $\frac{d^2v_2(t)}{dt^2}$ and $\frac{d^3v_2(t)}{dt^3}$ at $t = 0^+$.  Fig. Q6(a)	**10**	**L3**	**CO3**
	b.	For the circuit shown in Fig. Q6(b), the switch is closed at t = 0. Determine i, $\frac{di}{dt}$, $\frac{d^2i}{dt^2}$ and $\frac{d^3i}{dt^3}$ at $t = 0^+$.  Fig. Q6(b)	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	State and prove Initial Value Theorem.	**6**	**L2**	**CO3**
	b.	Find the Laplace Transform of the periodic waveform shown in Fig. Q7(b).  Fig. Q7(b)	**8**	**L3**	**CO3**

	c.	Using Laplace transform, determine the current i(t) in the circuit shown in Fig. Q7(c), when the switch 'S' is closed at t = 0. Assume zero initial conditions.	6	L3	CO3

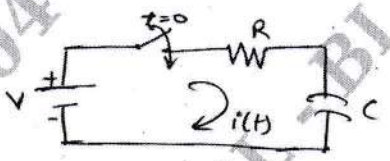
Fig. Q7(c)



OR

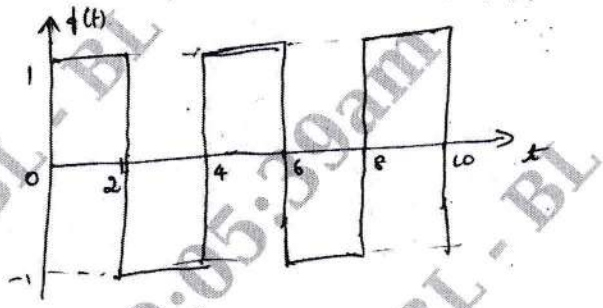
Q.8	**a.**	State and prove differentiate by 'S' domain property.	**6**	**L2**	**CO3**
	b.	In the circuit shown in Fig. Q8(b), the switch is closed at t = 0. Obtain the expression for the current.	**6**	**L3**	**CO3**

Fig. Q8(b)



	c.	Obtain the Laplace Transform of the square wave shown in Fig. Q8(c).	**8**	**L3**	**CO3**

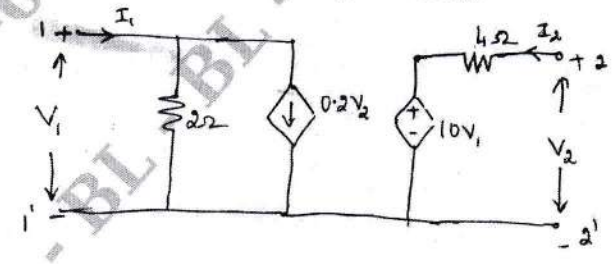
Fig. Q8(c)



Module – 5

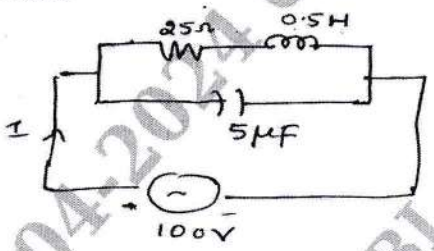
Q.9	**a.**	What are Impedance and Hybrid parameters? Derive the expression for the same.	**8**	**L2**	**CO4**
	b.	Derive an expression for Transmission parameters interms of Z – parameters.	**5**	**L2**	**CO4**
	c.	For the circuit shown in Fig. Q9(c), find Y – parameters.	**7**	**L3**	**CO4**

Fig. Q9(c)



OR

Q.10	**a.**	Derive an expression for bandwidth of a series Resonant circuit.	**7**	**L2**	**CO5**

	b.	A series RLC circuit consists of a resistance of 1 kΩ and an inductance of 100mH in series with capacitance of 10PF connected across 100V supply. Determine i) Resonant frequency ii) Quality factor iii) Maximum current in the circuit iv) Bandwidth v) Half power frequencies v) Selectivity factor.	**7**	**L3**	**CO5**
	c.	For the circuit shown in Fig. Q10(c), find i) Resonant frequency ii) Quality factor iii) Bandwidth iv) Impedance at resonance v) Current at resonance.  Fig. Q10(c)	**6**	**L3**	**CO5**

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BEC358B

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
MATLAB Programming

Time: 2 hrs. Max. Marks: 50

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Discuss the various output formats of MATLAB.	05	L2	CO1
	b.	Write a MATLAB program which creates a vector t with 10 elements : 1,2,3,……,10 and compute the following quantities. (i) $x = t.\sin(t)$ (ii) $y = \frac{t-1}{t+1}$ (iii) $z = \frac{\sin(t^2)}{t^2}$	05	L2	CO1
		OR			
Q.2	a.	Explain various file types of MATLAB.	05	L2	CO1
	b.	Write a MATLAB program to compute the following quantities : (i) $ln(e^3)$ (ii) $\log_{10}(10^5)$ (iii) solve $3^x = 17$ for x (iv) $\sin^2(\pi/6) + \cos^2(\pi/6)$ (v) $y = \cosh^2(x) - \sinh^2(x)$ with $x = 32\pi$	05	L2	CO1
		Module – 2			
Q.3	a.	Explain the steps involved in creating script files and executing them in MATLAB.	05	L2	CO2
	b.	Write a MATLAB program to plot $y = e^{-0.4x}\sin(x)$, for all $0 \le x \le 4\pi$, taking 10, 50 and 100 points in the internal.	05	L2	CO2
		OR			
Q.4	a.	Explain with an example, how to write and execute a function file.	05	L2	CO2
	b.	Write a function factorial to compute the factorial n! for any integer n in MATLAB. The input should be the number n and the output should be n!.	05	L2	CO2
		Module – 3			
Q.5	a.	Explain briefly, how to define and use anonymous functions in command-line computations.	05	L2	CO3
	b.	Write a MATLAB program to define an anonymous function of two variables $f(\mu, x) = \mu x - x^3$ and evaluate over a range of x for different values of μ.	05	L2	CO3
		OR			
Q.6	a.	Explain the three different kinds of files for reading data into MATLAB's workspace.	05	L2	CO3
	b.	Write a MATLAB program : (i) To define symbolically the trigonometric expression $z = \sin(x + y)$ and expand it. (ii) To find the second derivative of z with respect to x, i.e., find $\frac{\partial^2 z}{\partial x^2}$ (iii) $\int_0^{\pi/2}$	05	L2	CO3

		Module – 4			
Q.7	**a.**	Briefly explain two cases, where initialization of a matrix is always advisable.	**05**	**L2**	**CO4**
	b.	Identify the output of the following commands. i) eye (3) ii) B = [ones(3) zeros(3, 2) ; zeros(2, 3) 4*eye(2)] iii) diag (B)' iv) d = [2 4 6 8] d_1 = [–3 –3 –3] d_2 = [–1 –1] D = diag(d) + diag(d1, 1) + diag(d2,–2)	**05**	**L2**	**CO4**
		OR			
Q.8	**a.**	With an appropriate example, briefly explain inline functions used in MATLAB.	**05**	**L2**	**CO4**
	b.	Write a MATLAB program, which defines a 3×3 matrix A, for which find i) determinant of matrix A. ii) eigen values and eigenvectors of matrix A using MATLAB commands.	**05**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Briefly explain the loop statements used in MATLAB with examples.	**05**	**L2**	**CO4**
	b.	Let us consider the following system of linear equations: $\begin{bmatrix} 5 & 2r & r \\ 3 & 6 & 2r-1 \\ 2 & r-1 & 3r \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \end{Bmatrix} = \begin{Bmatrix} 2 \\ 3 \\ 5 \end{Bmatrix}$ Write a MATLAB program to solve the above linear equation for x and also calculate the determinant of the matrix by choosing the value of r = 1.	**05**	**L2**	**CO4**
		OR			
Q.10	**a.**	Briefly explain the following commands of MATLAB: (i) Error (ii) Input	**05**	**L2**	**CO4**
	b.	Write a MATLAB recursive function to compute n^{th} term of Fibonacci sequence.	**05**	**L2**	**CO4**

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18EC42

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Mention and explain the design issues of a classical biasing for BJT using collector-to-base feedback resistor and which uses single power supply. **(10 Marks)**

b. Design classical bias network of amplifier to establish a current $I_E = 1$ mA using a power supply $V_{CC} = +12$ V and transistor has $\beta = 100$. **(10 Marks)**

OR

2 a. Explain the design of biasing technique for discrete MOSFET by fixing V_G and connecting a resistance in source and drain-to-Gate feedback resistor. **(10 Marks)**

b. Determine voltage gain of transistor amplifier for the circuit shown in Fig.Q2(b). Assume $\beta = 100$.

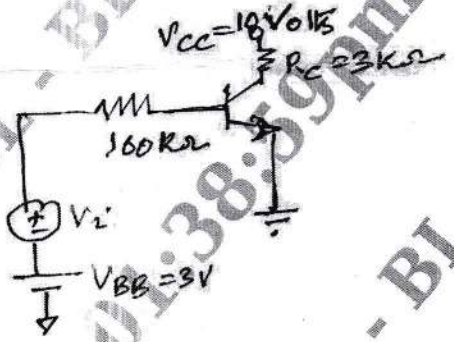

Fig.Q2(b) **(10 Marks)**

Module-2

3 a. Deduce and expression for upper cut off frequency of MOSFET – common source amplifier. **(10 Marks)**

b. Find the mid band gain A_M and the upper 3-dB frequency f_H of a CS amplifier fed with a signal source having an internal resistance $R_{sig} = 100$ KΩ. The amplifier has $R_G = 4.7$ MΩ, $R_D = R_L = 15$ KΩ. $g_m = 1$ mA/V, $r_0 = 150$ KΩ, $C_{gs} = 1$ PF and $C_{gd} = 0.4$ pf. **(10 Marks)**

OR

4 a. With a neat circuit diagram, explain the operation of FET based phase shift oscillator. **(10 Marks)**

b. With a neat circuit diagram, explain the operation of crystal oscillator along with relevant equation for frequency of oscillation. **(10 Marks)**

Module-3

5 a. Discuss the properties of negative feedback. **(10 Marks)**

b. Using ideal structure and equivalent circuit. Deduce an expression for input and output resistance of:
(i) Series shunt feedback amplifiers
(ii) Shunt-shunt configuration **(10 Marks)**

OR

6 a. Derive an expression efficiency of class C power amplifier. **(10 Marks)**

b. Deduce an expression for output resistance by discussing the circuit operation of class AB output stage. **(10 Marks)**

Module-4

7 a. For a practical inverting amplifier the values of R_1 and R_f are 470 Ω and 4.7 KΩ. The various specifications for opamp used are:
Open loop gain = 2×10^5
Input resistance = 2 MΩ
Output resistance = 75 Ω
Single break frequency = 5 Hz
Supply voltages = ±15V
Calculate closed loop voltage gain, i/p and o/p resistance and bandwidth with feedback. **(10 Marks)**

b. Mention and explain the requirements of a good instrumentation amplifier and analyze three opamp instrumentation amplifier. **(10 Marks)**

OR

8 a. Design an opamp Schmitt trigger with following specifications UTP = 2V, LTP = –4V and the output swings between ±10V. If the input is $5\sin\omega t$, plot the waveforms of input and output. **(10 Marks)**

b. Discussing the circuit operation of (i) DC amplifiers (ii) AC amplifiers, using OPAMPS. **(10 Marks)**

Module-5

9 a. Explain the circuit operation of monoshot using IC555. Derive the expression of pulse width. **(10 Marks)**

b. For the circuit shown in Fig.Q9(b), determine the lower cutoff frequency and then plot the frequency response of fitter.

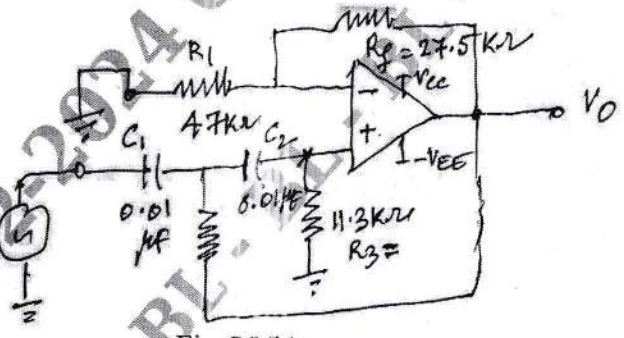

Fig.Q9(b) **(10 Marks)**

OR

10 a. Discuss the circuit operation of Astable multivibrator using IC555. Derive an expression for frequency of oscillations. **(10 Marks)**

b. Discuss the working of successive approximation ADC. **(10 Marks)**

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18EC43

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Control Systems

Time: 3 hrs. Max. Marks: 100

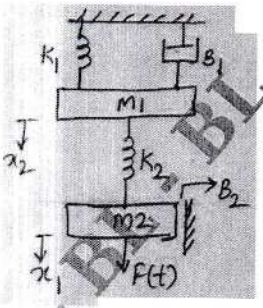
Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Differentiate between Open loop and Closed loop control systems. **(06 Marks)**

b. For a mechanical system shown in Fig. Q1(b), obtain analogous electrical network by F – V analogy. **(14 Marks)**

Fig. Q1(b)

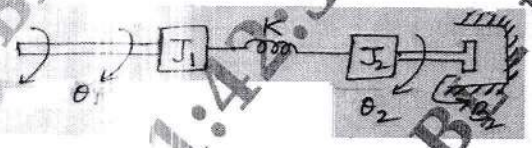


OR

2 a. Explain the terms : i) Physical system ii) Physical model iii) Mathematical model iv) Transfer function. **(08 Marks)**

b. For a mechanical system shown in Fig. Q2(b), obtain analogous electrical network by T – V analogy. **(12 Marks)**

Fig. Q2(b)

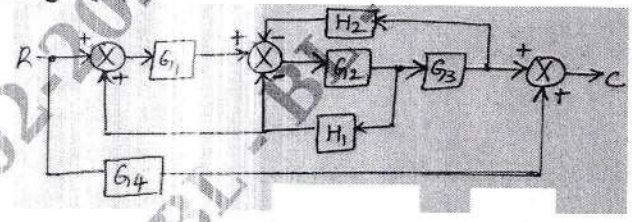


Module-2

3 a. Explain with block diagram, Reduction rules. **(08 Marks)**

b. Using the block diagram, reduction techniques, find the Closed – loop transfer function of the system shown in Fig. Q3(b). **(12 Marks)**

Fig. Q3(b)

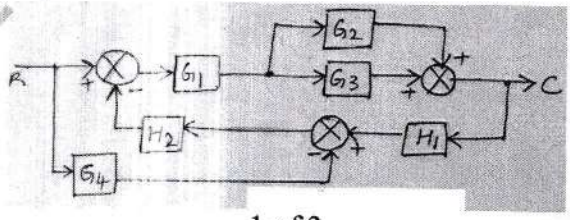


OR

4 a. Write Mason's gain formula for signal flow graph and indicate the each term. **(05 Marks)**

b. Draw the signal flow graph for the system shown in Fig. Q4(b) and find $\frac{C(s)}{R(s)}$. **(15 Marks)**

Fig. Q4(b)



Module-3

5 a. Derive the time response of a critically damped second order system subjected to unit step input. **(10 Marks)**

b. For a unity feedback control system with $G(s) = \frac{64}{S(s+9.6)}$, write the output response to a unit step input. Determine i) the response at $t = 0.1S$.
ii) Maximum value of the response and the time at which it occurs.
iii) Settling time at 2% tolerance. **(10 Marks)**

OR

6 a. Obtain the steady state errors of Type – 0 , Type – 1 and Type – 2 systems for unit step input and unit ramp input. **(12 Marks)**

b. Derive expressions for rise time and peak time of a under damped second order system. **(08 Marks)**

Module-4

7 a. Examine the stability of a system with characteristic equation
$S^5 + S^4 + 2S^3 + 2S^2 + 3S + 5 = 0$. **(06 Marks)**

b. Consider a feedback system with characteristic equation $1 + \frac{K}{S(s+1)(s+2)} = 0$. Draw the root locus and show clearly i) Breakaway points ii) The frequency at which root locus crosses imaginary axis and corresponding vale of K. **(14 Marks)**

OR

8 a. For the Bode plot shown in Fig. Q8(a), find the transfer function : **(10 Marks)**

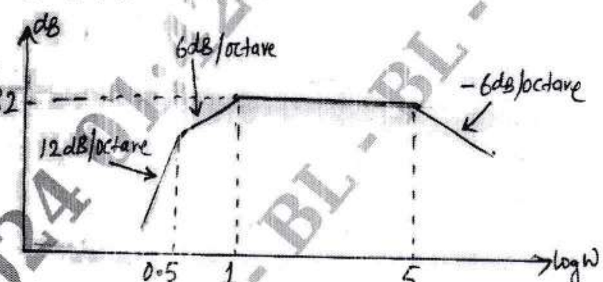
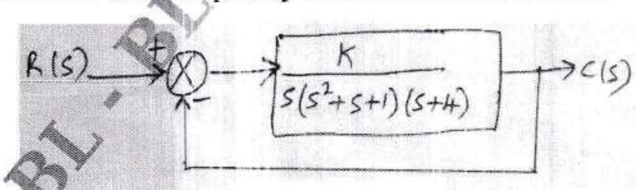


Fig. Q8(a)

b. Consider a Closed loop feedback system shown in Fig. Q8(b). Determine the range of K for which the system is stable using Routh criteria. Find the value of K that will cause sustained oscillation in the system. Also find frequency of sustained oscillation. **(10 Marks)**

Fig. Q8(b)



Module-5

9 a. Draw the Polar plot for a system with Open loop transfer function $G(s)\,H(s) = \frac{1}{1+Ts}$, where T is constant. **(06 Marks)**

b. A unity feedback system has $G(s) = \frac{10}{S(s+1)(s+2)}$. Draw the Nyquist plot and comment on Closed – loop stability. **(14 Marks)**

OR

10 a. Define State and State Variable. Explain the State model of linear systems. **(08 Marks)**

b. For a mechanical system shown in Fig.Q10(b), obtain the state model by choosing displacement x(t) and velocity v(t) as state variable. **(12 Marks)**

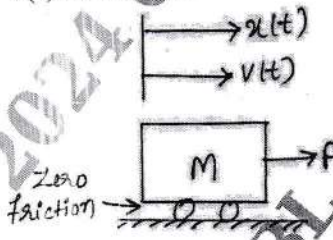


Fig. Q10(b)

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18EC44

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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 a random variable and briefly discuss the following terms associated with random variable.
(i) Sample space.
(ii) Distribute function.
(iii) Probability mass function.
(iv) Probability density function. **(06 Marks)**

b. The pdf for random variable Y is given by,

$$f_y(y) = \begin{cases} 1.5(1-y^2), & 0 < y < 1 \\ 0, & \text{otherwise} \end{cases}$$

(i) What are the mean?
(ii) What are the mean of square?
(iii) What are the variance of the random variable Y? **(06 Marks)**

c. Define an uniform random variable. Obtain the characteristics function of an uniform random variable and using the characteristic function derive its mean and variance. **(08 Marks)**

OR

2 a. The probability density function of a random variable 'x' is defined as,

$$f_x(x) = \begin{cases} K, e^{-4x} & x > 0 \\ 0 & x \le 0 \end{cases}$$

Find
(i) Constant K.
(ii) $P(1 < x < 2)$
(iii) $P(x \ge 3)$
(iv) $P(x < 1)$ **(08 Marks)**

b. Given the data in the following table :

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

(i) Plot the pdf and the cdf of the discrete random variable z.
(ii) Write expressions for $f_Z(2)$ and $F_Z(2)$ using unit delta function and unit step function respectively. **(06 Marks)**

c. Define Poisson distribution. Obtain the characteristic function of a Poisson random variable and using the characteristic function derive its mean and variance. **(06 Marks)**

Module-2

3 a. The joint pdf $f_{xy}(x,y) = C$, a constant, when $(0 < x < 2)$ and $(0 < y < 3)$ and is 0 otherwise.

(i) What is the value of constant C?
(ii) What are the pdfs for X and Y?
(iii) What is $F_{XY}(x, y)$ when $(0 < x < 2)$ and $(0 < y < 3)$?
(iv) What are $F_{XY}(x, \infty)$ and $F_{XY}(\infty, y)$?
(v) Are x and y independent? **(10 Marks)**

b. The mean and variance of random variable x are -2 and 3 ; the mean and variance of y are 3 and 5. The covariance Cov(xy) = -0.8. What are the correlation coefficient ρ_{XY} and the correlation E[XY]. **(06 Marks)**

c. Define correlation coefficient of random variable X and Y. Show that it is bounded by limit ± 1. **(04 Marks)**

OR

4 a. The zero mean bivariate random variables X_1 and X_2 have the following variances : $Var[X_1] = 2$ and $Var[X_2] = 4$. Their correlation coefficient is 0.8. Random variables Y_1 and Y_2 are obtained from,

$Y_1 = 3X_1 + 4X_2$, $Y_2 = -X_1 + 2X_2$

Find values for $Var[Y_1]$, $Var[Y_2]$ and $COV[Y_1 Y_2]$ **(08 Marks)**

b. X is a random variable uniformly distributed between 0 and 3. Z is a random variable, independent of X, uniformly distributed between +1 and -1. U = X + Z, what is the pdf for U? **(08 Marks)**

c. Explain briefly the following random variables:
(i) Chi-square Random variable.
(ii) Raleigh Random variable. **(04 Marks)**

Module-3

5 a. With the help of an example, define Random process and discuss the terms Strict-Sense Stationary (SSS) and Wide Sense Stationary (WSS) associated with a random process. **(06 Marks)**

b. Two jointly wide sense stationary random process have the same functions of the form $x(t) = A\cos(w_0 t + \theta)$ and $y(t) = B\cos(w_0 t + \theta + \phi)$. Here A, B and ϕ are constants, θ is the random variable uniformly distributed between 0 to 2π. Find the cross correlation function $R_{XY}(t)$. **(06 Marks)**

c. Define the Autocorrelation function (ACF) of the random process X(t) and prove the following statements :
(i) ACF is an even function.
(ii) If X(t) is periodic with period T, then in the WSS case, ACF is also periodic with period T. **(08 Marks)**

OR

6 a. A random process is described by,

$X(t) = A\sin(w_c t + \theta)$

Where A and w_c are constants and where θ is a random variable uniformly distributed between $\pm\pi$. Is x(t) wide sense stationary. If not, then why not? If so, then what are the mean and the autocorrelation function for the random process? **(06 Marks)**

b. x(t) and y(t) are zero-mean, jointly wide sense stationary random processes. The random process z(t) is,

$z(t) = 3x(t) + y(t)$.

Find the correlation functions $R_Z(\tau)$, $R_{ZX}(\tau)$, $R_{XZ}(\tau)$ and $R_{YZ}(\tau)$. **(08 Marks)**

c. Assume that the data in the following table are obtained from a windowed sample function obtained from an ergodic random process. Estimate the autocorrelation function for $\tau = 0, 3$ and 6 ms, where $\Delta t = 3$ ms.

x(t)	1.0	2.2	1.5	−3.0	−0.5	1.7	−3.5	−1.5	1.6	−1.3
k	0	1	2	3	4	5	6	7	8	9

(06 Marks)

Module-4

7 a. Determine if the following set of vectors will be basis for R^3.
$u_1 = (1,-1,1), u_2 = (0,1,2), u_3 = (3,0,-1)$ **(05 Marks)**

b. Determine if the following sets of vectors are linearly independent or linearly dependent :
$v_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}, v_2 = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$ and $v_3 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$. **(05 Marks)**

c. Apply Gram-Schmitt process to the vectors $v_1 = (2,2,1)$, $v_2 = (1,3,1)$ and $v_3 = (1,2,2)$ to obtain an orthonormal basis for $v_3(R)$ with standard inner product. **(10 Marks)**

OR

8 a. Determine Rank of the matrix A, $A = \begin{bmatrix} 1 & 3 & 9 \\ 4 & 1 & 3 \\ 9 & 4 & 12 \end{bmatrix}$. **(04 Marks)**

b. Solve Ax = b by least squares and find the projections of b on to the column space of A.
$A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix}$ and $b = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$ **(06 Marks)**

c. Explain the following :
(i) Rank Nullity theorem.
(ii) Gram-Schmidt orthogonalization procedure. **(10 Marks)**

Module-5

9 a. Briefly explain the following :
(i) Cofactors of the determinant.
(ii) Symmetric matrix and its properties. **(04 Marks)**

b. If $A = \begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$. Find eigen values and corresponding eigen vectors for matrix A. **(08 Marks)**

c. Factor the matrix A into $P^{-1}AP$ using diagonalization and hence find D^4.
$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ **(08 Marks)**

OR

10 a. If $A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ show that matrix A is positive definite matrix. **(04 Marks)**

b. Diagonalize the following matrix if possible :

$$A = \begin{bmatrix} 1 & 3 & 3 \\ -3 & -5 & -3 \\ 3 & 3 & 1 \end{bmatrix}$$ **(06 Marks)**

c. Factorize the matrix A into $A = U \sum V^T$ using SVD.

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

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18EC45

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Define Signal. List the various classifications of signals with suitable expressions/diagrams. **(06 Marks)**

b. Sketch the even and odd components of the following signals

i) $x(n) = u(n) - u(-n-1)$

ii) $x(t) = r(t) - 2r(t-1) + r(t-2)$ where $r(t) = t \cdot u(t)$. **(08 Marks)**

c. Determine whether the following signals are energy or power signals. Also determine their average power/total energy

i) $x(n) = \alpha^n u(n)$ ii) $x(t) = 5ws(\pi t)$. **(06 Marks)**

OR

2 a. List all the continuous time elementary signals with necessary expressions and suitable diagrams. **(06 Marks)**

b. Determine whether the following signals are periodic or not. If periodic, determine their fundamental period

i) $x(n) = \text{Cos}\left(\frac{\pi}{2}n\right) \cdot \text{Cos}\left(\frac{\pi}{4}n\right)$

ii) $x(t) = 2\text{Cos}\,t + 3\text{Cos}(\pi t)$ **(06 Marks)**

c. For signals x(t) and y(t) as given in Fig Q2(c), sketch the following

i) $x(2t) \cdot y\left(\frac{1}{2}t+1\right)$ ii) $x(t+1)(2-1)$.

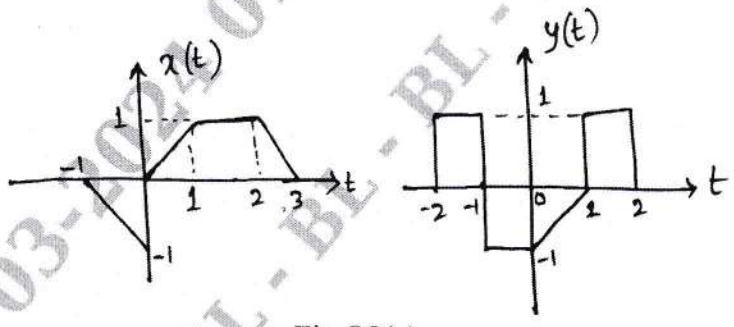

Fig Q2(c) **(08 Marks)**

Module-2

3 a. List all the basic system properties with respect to continuous time systems, with definition, necessary expressions and example. **(08 Marks)**

b. Convolute $x(n) = \{1, 2, \underset{\uparrow}{-1}, 1\}$ and $h(n) = \{1, \underset{\uparrow}{0}, 1\}$ using graphical method. **(04 Marks)**

c. For an LTI system characterized by impulse response $h(n) = \beta^n u(n)$, $0 < \beta < 1$, find the output of the system for input x(n) given by $x(n) = \alpha^n [u(n) - u(n-10)]$. **(08 Marks)**

OR

4 a. Determine whether the systems given by the following input output are causal, linear, time – invariant, stable. Justify
i) $y(n) = (n + 1)\, x(n)$ ii) $y(t) = x(t) + 10$ **(08 Marks)**

b. Derive the equation for convolution sum. **(04 Marks)**

c. Convolute the signals $x_1(t) = \{u(t + 2) - u(t - 1)\}$ and $x_2(t) = u(2 - t)$. **(08 Marks)**

Module-3

5 a. State and prove the associative property of convolution integral. **(04 Marks)**

b. Given the impulse response, determine whether each of the following systems are stable, memoryless, causal. Justify your answer with suitable explanation. **(08 Marks)**
i) $h(n) = (0.8)^n\, u(n + 2)$
ii) $h(t) = e^{-6t} u(3 - t)$

c. Obtain the Fourier series representation for the signal $x(t) = \text{Sin}(2\pi t) + \text{Cos}(3\pi t)$. Sketch the magnitude and phase spectra. **(08 Marks)**

OR

6 a. Evaluate the step response for the systems with impulse response as given below.
i) $h(t) = e^{-|t|}$
ii) $h(n) = \left(\frac{1}{2}\right)^n u(n)$ **(10 Marks)**

b. Find the Fourier series of the signal shown in Fig Q6(b)

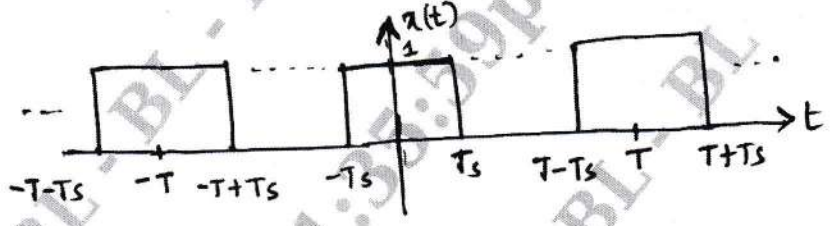

Fig Q6(b) **(10 Marks)**

Module-4

7 a. State and prove the time shift property of Discrete Time Fourier Transform. **(04 Marks)**

b. Evaluate the Fourier transform of the following signals. Also draw spectrum. **(08 Marks)**
i) $x(t) = e^{-at} \cdot u(t), a > 0$
ii) $x(t) = \delta(t)$

c. Evaluate the DTFT for the signal x(n) shown in Fig Q7(c)

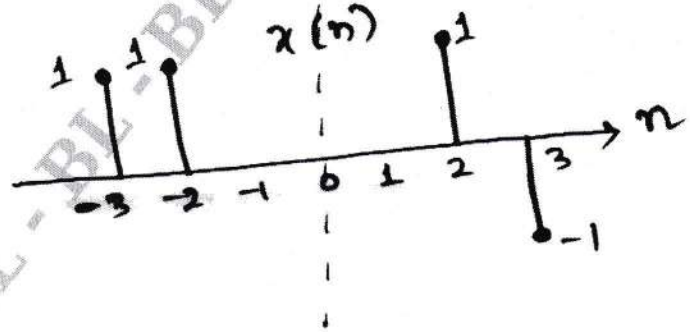

Fig Q7(c) **(08 Marks)**

OR

8 a. Using appropriate properties, find the DTFT of the signal $x(n) = \text{Sin}\left(\frac{\pi}{4}n\right)\left(\frac{1}{4}\right)^n u(n-1)$. **(08 Marks)**

b. Determine the inverse Fourier transform of the following signals

i) $x(jw) = \frac{5jw+12}{(jw)^2+5jw+6}$

ii) $x(jw) = \frac{jw}{(2+jw)^2}$ **(08 Marks)**

c. State and prove time differentiation property of Fourier transform. **(04 Marks)**

Module-5

9 a. List all the properties of Region of convergence (ROC). **(04 Marks)**

b. Determine the Z-transform, the ROC and the locations of poles and zeros of x(z) for the following signals

i) $x(n) = -\left(\frac{3}{4}\right)^n u(-n-1) + \left(\frac{-1}{3}\right)^n u(n)$

ii) $x(n) = n \cdot \text{Sin}\left(\frac{\pi}{2}n\right)u(-n)$ **(08 Marks)**

c. Find the inverse z-transform of $x(z) = \frac{1-z^{-1}+z^{-2}}{\left(1-\frac{1}{2}z^{-1}\right)(1-2z^{-1})(1-z^{-1})}$ with following ROCs

i) $1 < |z| < 2$

ii) $\frac{1}{2} < |z| < 1$. **(08 Marks)**

OR

10 a. Determine the z-transform and ROC for the signal $x(n) = \left(\frac{1}{2}\right)^n \{u(n) - u(n-10)\}$. **(04 Marks)**

b. Using power series expansion method, determine inverse Z-transform of

i) $x(z) = \text{Cos}(z^{-2})$ ROC $|z| > 0$

ii) $x(z) = \frac{1}{1-\left(\frac{1}{4}\right)z^{-2}}$ ROC $|z| > \frac{1}{4}$. **(08 Marks)**

c. Find the transfer function and the impulse response of a causal LTI system if the input to the system is $x(n) = \left(-\frac{1}{3}\right)^n u(n)$ and the output is $y(n) = 3(-1)^n u(n) + \left(\frac{1}{3}\right)^n u(n)$. **(08 Marks)**

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CBCS SCHEME

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18EC46

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Microcontroller

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 block diagram explain the architecture of 8051 microcontroller. **(10 Marks)**

b. Explain when overflow, auxiliary and parity flag bit is set in 8051 Program Status Word (PSW) register. What will be the value of PSW after the execution of following instructions:

```
MOV A, #40H
MOV B, #3FH
ADD A, B
```

(10 Marks)

OR

2 a. Interface 8051 microcontroller with 4KB of ROM and 64KB of RAM. **(10 Marks)**

b. With diagram explain the structure of RAM. **(05 Marks)**

c. Explain Port0 pin configuration with a diagram. **(05 Marks)**

Module-2

3 a. What is an addressing mode? Explain the different types of addressing modes with an example each. **(10 Marks)**

b. Explain the operation of following instructions with one example each:
i) PUSH ii) XRL A, B iii) DIV A B **(06 Marks)**

c. Write assembly level program to add the contents of A and B Register and store result in 50H location. **(04 Marks)**

OR

4 a. Explain conditional and unconditional Jump instruction with an example. **(08 Marks)**

b. Check if the instructions given are valid or not. Write the reason and correct the invalid instruction.
(i) MOV R_0 , DPT R (ii) MOV A , @Ry
(iii) MOV #20H, 30H (iv) MOV R_0 , @R_1 **(08 Marks)**

c. Write assembly level program to multiply the contents of A and B register and store result in 30H location. **(04 Marks)**

Module-3

5 a. What is a subroutine? Explain the advantages of a subroutine. What are the sequence of operations that takes place when call and return instructions are executed? **(08 Marks)**

b. With a diagram explain stack structure and its operation. **(07 Marks)**

c. Write assembly level program to check the position of switch connected to $P_{0.0}$. If the switch is ON turn on LED connected to $P_{1.0}$. **(05 Marks)**

OR

6 a. Explain PUSH and POP instructions with an example. **(08 Marks)**
b. Write assembly level program to add two numbers stored in locations 20H and 21H using stack instructions. **(04 Marks)**
c. Explain CALL and RET instructions. **(08 Marks)**

Module-4

7 a. With the bit pattern explain TMOD register. **(08 Marks)**
b. Explain autoreload mode of timer1. How to make timer1 work as a counter? **(08 Marks)**
c. Write assembly level program using autoreload mode of timer0 to generate a frequency of 10 kHz on $P_{1.2}$. **(04 Marks)**

OR

8 a. With a bit pattern explain TCON register. **(08 Marks)**
b. Explain bit pattern of SCON register. **(08 Marks)**
c. Explain the importance of MAX232IC in serial communication. **(04 Marks)**

Module-5

9 a. With a bit pattern explain IE register. Explain how interrupt priority can be changed using IP register. **(10 Marks)**
b. With a diagram explain 8051 interface with ADC. Write a assembly level code to interface ADC 0804 to 8051 microcontroller. **(10 Marks)**

OR

10 a. Explain stepper motor interface with a microcontroller. Write assembly level code to run stepper motor continuously in clockwise direction. **(10 Marks)**
b. Explain DAC interface with 8051 microcontroller. Write a program to generate any waveform. **(10 Marks)**

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CBCS SCHEME

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18MAT41

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. State and prove Cauchy – Riemann equations in Cartesian form. **(07 Marks)**

b. Find the analytic function $f(z) = u + iv$, given that $u - v = e^x[\cos y - \sin y]$. **(07 Marks)**

c. If $y(z)$ is an analytic function, then show that :

$$\left\{\frac{\partial}{\partial x}|f(z)|\right\}^2 + \left\{\frac{\partial}{\partial y}|f(z)|\right\}^2 = |f'(z)|^2 .$$ **(06 Marks)**

OR

2 a. Determine the analytic function f(z), where imaginary part is $\left(\gamma - \frac{K^2}{\gamma}\right)\sin\theta$, $r \neq 0$. Hence find the real part 07 f(z). **(07 Marks)**

b. Find the analytic function f(z), whose real part is $u = \log\sqrt{x^2 + y^2}$. **(07 Marks)**

c. Show that $f(z) = z^u$ is analytic and hence find its derivative. **(06 Marks)**

Module-2

3 a. Discuss the transformation $w = z^2$. **(07 Marks)**

b. State and prove Cauchy's integral theorem. **(07 Marks)**

c. Evaluate : $\int_0^{(2+i)} (\bar{z})^2 dz$, along the real axis up to 2 and then vertically to 2 + i. **(06 Marks)**

OR

4 a. Evaluate : $\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)} dz$ where c is the circle $|2| = 3$. **(07 Marks)**

b. Find the bilinear transformation that maps the points $z = 1, i, -1$ onto $w = 0, 1, \infty$. **(07 Marks)**

c. Evaluate : $\int_{(1-i)}^{(2+i)} (2x + iy + 1)\, dz$ along the straight line joining the points (1, –1) and (2, 1). **(06 Marks)**

Module-3

5 a. A coin is tossed twice. If x represents the number of heads turning up, find the probability distribution of x. also find its mean and variance. **(07 Marks)**

b. If 2% of the fuses manufactured by a firm are defective. Find the probability that a box containing 200 fuses contains : i) no defective fuses ii) 3 or more defective fuses. **(07 Marks)**

c. In a normal distribution, 31% of the items are below 45 and 8% of the items are above 64. Find the mean and standard deviation of the distribution. Given that : A(1.4) = 0.42 and A(0.5) = 0.1915. **(06 Marks)**

OR

6 a. Find the constant K such that

$$f(x) = \begin{cases} Kx^2; & -3 \le x \le 3 \\ o; & \text{otherwise} \end{cases}$$

is a probability density function. Also find :

i) $P(1 \le x \le 2)$

ii) $P(x \le 2)$

iii) $P(x > 1)$. **(07 Marks)**

b. When a coin is tossed 4 items, find the probability of getting

i) exactly one head

ii) at most 3 heads

iii) at least 2 heads. **(07 Marks)**

c. If x is an exponential variate with mean 5. Evaluate :

i) $P(0 < x <)$

ii) $P(-\infty < x < 10)$

iii) $P(x \le 0)$ or $(x \ge 1)$. **(06 Marks)**

Module-4

7 a. Find the coefficient of correlation and the lines of regression for the following data :

x	1	2	3	4	5
y	2	5	3	8	7

(07 Marks)

b. Fit a curve of the form $y = ax^b$ for the data :

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

(07 Marks)

c. If the equations of regression lines of two variables x and y are $x = 19.13 - 0.879$ and $y = 11.64 - 0.5x$. Find the correlation coefficient and the means of x and y. **(06 Marks)**

OR

8 a. Compute the rank correlation coefficient for the following data :

x	68	64	75	50	64	80	75	40	55	64
y	62	58	68	45	81	60	68	48	50	70

(07 Marks)

b. Fit a parabola $y = a + bx + cx^2$ by the method of least squares to the following data :

x	1	2	3	4	5	6	7
y	2.3	5.2	9.7	16.5	29.4	35.5	54.4

(07 Marks)

c. Compute the mean values of x and y and the coefficient correlation for the regression lines $2x + 3y + 1 = 0$ and $x + 6y - 4 = 0$. **(06 Marks)**

Module-5

9 a. The joint probability distribution of two random variables x and y is defined by the function $P(x, y) = \frac{1}{27}(2x + y)$, where x and y assume the values 0, 1, 2. Find the marginal distributions of x and y. Also compute E(x) and E(y). **(07 Marks)**

b. Fit a Poisson distribution for the following data and test the goodness of fit. Given that $\Psi^2_{0.05} = 9.49$ for degrees of freedom 4. **(07 Marks)**

c. Write short notes on :
   i) Null hypothesis
   ii) Type – I and Type – II
   iii) Level of significance. **(06 Marks)**

OR

10 a. Joint probability distribution of two random variables is given by the following data :

x \ y	–3	2	4
1	0.1	0.2	0.2
3	0.3	0.1	0.1

Find :
   i) Marginal distributions of x and y
   ii) Cov(x, y)
   iii) P(x, y). **(07 Marks)**

b. The following are the I·Q's of a randomly chosen sample of 10 boys.
70, 120, 110, 101, 88, 83, 95, 98, 107, 100
Does this data support the hypothesis that the population mean of I·Q's is 100 at 5% level of significance? Given $t_{0.05} = 2.26$. **(07 Marks)**

c. A sample of 900 items is found to have the mean 3.4. Can it be reasonably regarded as a truly random sample from a large population with mean 3.25 and standard deviation 1.61 at 5% level of significance? Given $Z_{0.05} = 1.96$ (Two Tailed Test). **(06 Marks)**

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① 21: IV Sem. EC

CBCS SCHEME

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21EC42

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Digital Signal Processing

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. Prove that the sampling of Fourier transform of a sequence x(n) results in N – point DFT using which both the sequence and the transform can be reconstructed. **(10 Marks)**

b. Compute the N – point DFT of $x(n) = a^n$ for $0 \le n \le N - 1$. And also find the DFT of the sequence $x(n) = 0.5n\, u(n)$; $0 \le n \le 3$. **(10 Marks)**

OR

2 a. Compute the circular convolution of the sequences and compare the results with linear convolution. (Use time domain approach).
$x(n) = \{1, 1, 1, 1, -1, -1, -1, -1\}$; $h(n) = \{0, 1, 2, 3, 4, 3, 2, 1\}$. **(10 Marks)**

b. If x(n(= {1, 2, 0, 3, -2, 4, 7, 5}, Evaluate the following :

i) x(0) ii) x(4) iii) $\sum_{k=0}^{7} x(k)$ iv) $\sum_{k=0}^{7} |x(k)|^2$.

Show that x(0) is always real. **(10 Marks)**

Module-2

3 a. State and prove the Periodicity property and Symmetry property of twiddle factor. **(05 Marks)**

b. Given x(n) = {1, 2, 3, 4} and h(n) = {1, 2, 2}. Compute Linear convolution using circular convolution. **(05 Marks)**

c. Develop an 8 – point DIT – FFT algorithm. Draw the signal flow graph. Determine the DFT of the sequence, x(n) = {1, 1, 1, 1, 0, 0, 0 , 0}. Using the signal flow graph, show all the intermediate results on the signal flow graph. **(10 Marks)**

OR

4 a. Find the response of LTI system with an impulse response h(n) = {3, 2, 1} for the input x(n) = {2, +1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1}. Using overlap add method use 8 – point circular convolution. **(10 Marks)**

b. What do you mean by computational complexity? Compare the direct computation and FFT algorithm. In the direct computation of 256 – point DFT of x(n). How many
i) Complex multiplications ii) Complex additions iii) Real multiplications
iv) Real additions and v) Trigonometric function evaluations are required. **(10 Marks)**

Module-3

5 a. Design an FIR filter for the following desired frequency response

$$H_d(w) = \begin{cases} e^{-j3w} & \text{if } |w| \le \pi/4 \\ 0 & \text{if } |w| > \pi/4 \end{cases}$$

Use the Hanning window function. Obtain the frequency response of the designed FIR filter. **(10 Marks)**

b. A FIR filter is given by $y(n) = x(n) + \frac{2}{5}x(n-1) + \frac{3}{4}x(n-2) + \frac{1}{3}x(n-3)$.

Draw the lattice structure and direct form. **(10 Marks)**

OR

6 a. Design a low pass digital filter to be used in an A/D – H(2) – D/A structure that will have a -3 dB cutoff at 30 π rad/sec and an attenuation of 50dB at 45 π rad/sec. The filter is required to have a linear phase and the system will use a sampling rate of 100 samples 1 second. **(10 Marks)**

b. Given $H(z) = (1 + 0.6z^{-1})^5$. i) Realize in direct form ii) Realize as a cascade of first order sections only iii) As a cascade of 1st and 2nd order sections. **(10 Marks)**

Module-4

7 a. Derive an expression for order and cut off frequency of the Butterworth filter. **(10 Marks)**

b. Realize the following difference equation using digital structures :

i) Direct form – I ii) Direct form – II

$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{3}x(n-1)$. **(10 Marks)**

OR

8 a. The system function of the analog filter is given as $H_a(S) = \frac{S+0.1}{(S+0.1)^2+16}$. Obtain the system function of the digital filter using bilinear transformation which is resonant at $w_r = \pi/2$. **(10 Marks)**

b. Realize the following system functions

$H(z) = \frac{8z^3 - 4z^2 + 11z - 2}{(z-0.25)(z^2 - 2 + 0.5)}$. Using direct form – II. **(05 Marks)**

c. List the characteristics of commonly using Analog filters. **(05 Marks)**

Module-5

9 a. Explain the digital signal processors based on Harvard architecture. **(10 Marks)**

b. Discuss briefly the following special digital signal processor hardware units :

i) Multiplier and Accumulator (μAC0 unit ii) Shifters iii) Address Generators. **(10 Marks)**

OR

10 a. Explain Fixed – Point digital signal process using basic architecture of TMS320C54X family. **(10 Marks)**

b. Illustrate the operation of circular buffers used for address generation in DS processors. **(10 Marks)**

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CBCS SCHEME

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

21EC43

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Circuits and Controls

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 power delivered to 4 Ω Resistor shown in Fig. Q1 (a) using mesh analysis. **(07 Marks)**

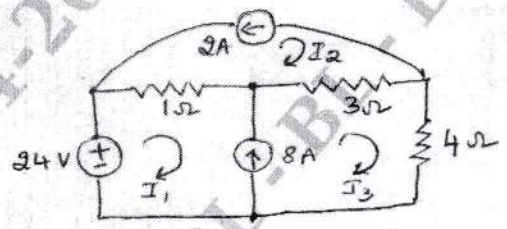

Fig. Q1 (a)

b. Find the Thevinin's equivalent circuit shown in Fig. Q1 (b) with respect to terminals a - b. **(07 Marks)**

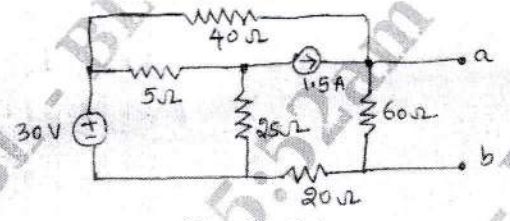

Fig. Q1 (b)

c. Explain superposition and Thevinin's theorems. **(06 Marks)**

OR

2 a. For the circuit shown in Fig. Q2 (a), find the voltage V_x. Use nodal analysis. **(07 Marks)**

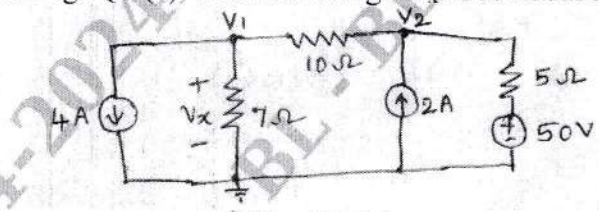

Fig. Q2 (a)

b. State and prove maximum power transfer theorem for DC circuits. **(06 Marks)**

c. Find the maximum power dissipated in R_L shown in Fig. Q2 (c).

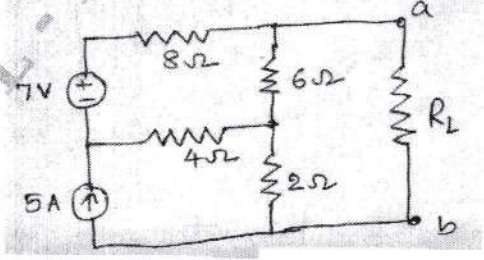

Fig. Q2 (c) **(07 Marks)**

Module-2

3 a. State and prove initial and final value theorems. **(06 Marks)**

b. Find Laplace transform of f(t) shown in Fig. Q3 (b).

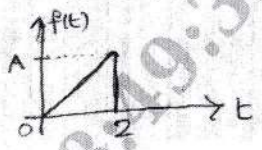

Fig. Q3 (b)

c. Determine z-parameters for the network shown in Fig. Q3 (c). **(07 Marks)**

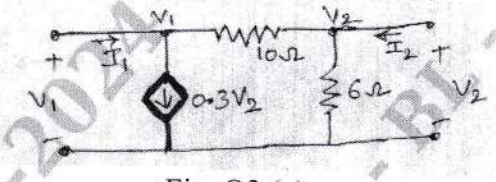

Fig. Q3 (c) **(07 Marks)**

OR

4 a. Find Laplace transform of unit impulse, unit step and unit ramp functions. **(06 Marks)**

b. For the circuit shown in Fig. Q4 (b). Find i(t). Assume $V_C(0) = 10$ V and $i(0) = 0$ A.

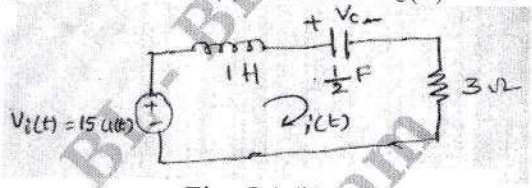

Fig. Q4 (b) **(07 Marks)**

c. Find h-parameters for the circuit shown in Fig. Q4 (c).

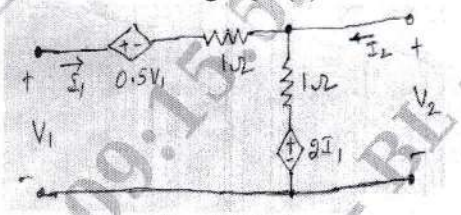

Fig. Q4 (c) **(07 Marks)**

Module-3

5 a. For the signal flow graph shown in Fig. Q5 (a), find $\frac{C(s)}{R(s)}$ by using Mason's gain formula. **(08 Marks)**

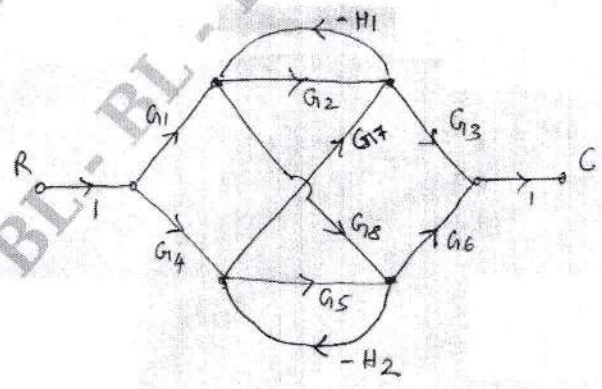

Fig. Q5 (a)

b. Explain Mason's gain formula. **(04 Marks)**

c. Reduce the block diagram, shown in Fig. Q5 (c) and find $\frac{C(s)}{R(s)}$ by using block diagram reduction techniques.

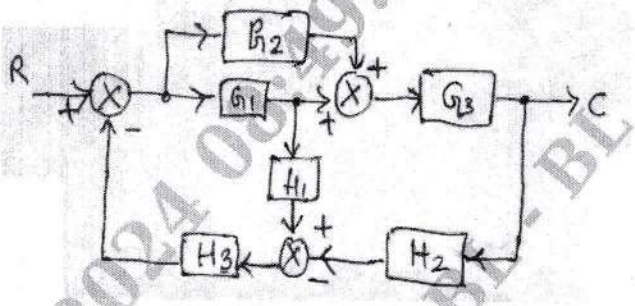

Fig.Q5 (c)

(08 Marks)

OR

6 a. Explain with a specimen signal flow graph the following :

(i) Forward path and forward path gain.
(ii) Loop and loop gain.
(iii) Non touching loops.
(iv) Input and output nodes. **(04 Marks)**

b. Find $\frac{C(s)}{R(s)}$ for the signal flow graph shown in Fig. Q6 (b).

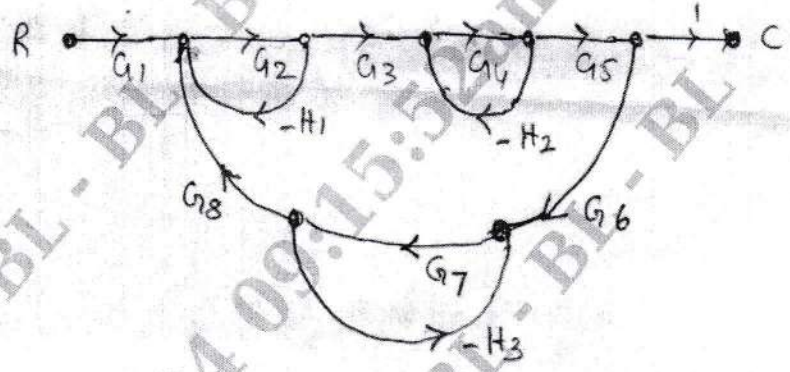

Fig. Q6 (b)

(08 Marks)

c. Find $\frac{C}{R}$ for the block diagram, shown in Fig. Q6 (c) using block diagram reduction technique.

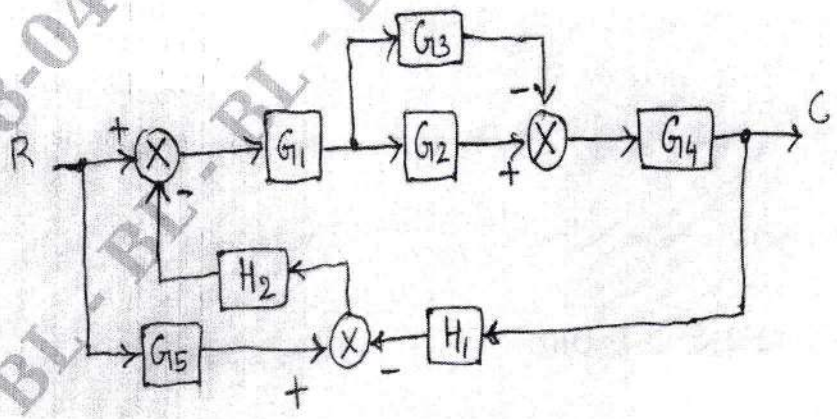

Fig. Q6 (c)

(08 Marks)

Module-4

7 a. Derive time-domain expression for the unit step response of a second order under damped system subjected to a unit step input. **(08 Marks)**

b. A unity feedback system has an open-loop transfer function,

$$G(s)H(s) = \frac{K}{s(s+10)}$$

Find the value of K so that the system will have a damping ratio of 0.5. For thin value of K, find rise time, peak time, peak over shoot and settling time corresponding to unit step response of the system. **(06 Marks)**

c. Refer the characteristic equation, given below $s^4 + 25s^3 + 15s^2 + 20s + K = 0$, $K > 0$
Find the range of K for closed loop stability. Use RH criterion. **(06 Marks)**

OR

8 a. State and derive expression for t_p, M_P and t_r corresponding to unit step response of a second order under damped system. **(08 Marks)**

b. A unity feed back system has an open – loop transfer function,

$$G(s)H(s) = \frac{K(1-s)}{s(s^2+5s+9)}.$$

Find the range of K for closed loop stability. Use RH criterion. **(06 Marks)**

c. Measurements conducted on a closed loop system reveals the unit step response to be,
$C(t) = 1 + 0.2e^{-60t} - 1.2e^{-10t}$, $t \geq 0$.

(i) Obtain the closed loop transfer function of the system
(ii) Find natural frequency and damping ratio of the system. **(06 Marks)**

Module-5

9 a. Sketch the root-locus plot, if the open loop transfer function,

$$G(s)H(s) = \frac{K(s+6)}{s(s+1)(s+2)}.$$

Show all the salient points on the root locus. **(12 Marks)**

b. Compute the state transition matrix for the given system matrix,

$A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ using Laplace approach. **(08 Marks)**

OR

10 a. Sketch the root-locus plot for a negative feedback system having an open-loop transfer function.

$$G(s)H(s) = \frac{K}{s(s+1)(s+2)}, \quad K > 0$$ **(12 Marks)**

b. Obtain the state-transition matrix of the following system:

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Also, find the inverse of state-transition matrix. **(08 Marks)**

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21EC44

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Communication Theory

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain in detail, the working of switching modulator with suitable block diagram and necessary derivation. **(08 Marks)**

b. Explain the concept of VSB transmission for analog and digital transmission. **(06 Marks)**

c. Explain with block diagram of FDM system. **(06 Marks)**

OR

2 a. Explain the generation of DSBSC wave using a ring modulator. **(07 Marks)**

b. Explain the scheme of generation and demodulation of VSB modulated wave with relevant spectrum of signals and mathematical expression. **(08 Marks)**

c. An audio frequency signal $m(t) = 5 \sin 2\pi \times 10^3 t$ is used to amplitude modulate a carrier of $c(t) = 100 \sin 2\pi\ 10^6 t$. Assume modulation index of 0.4. Find:

i) Side band frequencies
ii) Amplitude of each side band
iii) Band width
iv) Total power delivered to a load of 100Ω
v) Find the efficiency of AM wave assume R = 1Ω. **(05 Marks)**

Module-2

3 a. Explain the narrowband FM with relevant expressions and phasor diagram. **(10 Marks)**

b. Discuss the non-linear effects in FM system. **(06 Marks)**

c. When a 50MHzs carrier is frequency modulated by a sinusoidal AF modulating signal. The highest frequency reached is 50.405MHzs. Calculate :

i) Frequency deviation produced
ii) Carrier swing of the wave
iii) Lowest frequency reached. **(04 Marks)**

OR

4 a. Derive the expression for linear model of PLL. **(08 Marks)**

b. Explain FM stereo multiplexing. **(06 Marks)**

c. With a neat diagram, explain the superheterodyne receiver. **(06 Marks)**

Module-3

5 a. Derive the expression of Figure of Merit (FOM) of an AM receivers using envelop detection. **(06 Marks)**

b. Explain shot noise and thermal noise with relevant diagrams and expressions. **(08 Marks)**

c. Discuss the FM threshold effect and its reduction method. **(06 Marks)**

OR

6 a. Derive the expression of figure of merit for a DSB-SC receiver. **(10 Marks)**

b. Explain the use of pre emphasis and de-emphasis circuit in an FM system. **(06 Marks)**

c. An AM receiver operating with a sinusoidal modulating signal has a following specification m = 0.8 and $(SNR)_0$ = 30dB. What is the carrier to noise ratio. **(04 Marks)**

Module-4

7 a. State sampling theorem and explain the sampling theorem with relevant equation. **(10 Marks)**

b. With neat block diagram, explain TDM. **(06 Marks)**

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

OR

8 a. With a neat diagram, explain the generation and detection of PPM. **(08 Marks)**

b. With a neat diagram, explain the generation of PAM waves. **(08 Marks)**

c. A Compact Disc (CD) Audio signals digitally using PCM. Assume the audio signal B.W to be 20kHzs.

i) What is the Nyquist rate?

ii) If the Nyquist samples are quantized to L = 65.536 levels and then binary coded. Determine the number of bits required to encoded a sample.

iii) Determine the number of binary digits / sec required to encode the audio S/R. **(04 Marks)**

Module-5

9 a. With a neat diagram, explain the basic elements of a PCM. **(08 Marks)**

b. Discuss the concept and operation of delta modulation. **(08 Marks)**

c. A TV signal with a Bandwidth of 4.2MHzs is transmitted using binary PCM. The number of representation level is 512. Calculate:

i) Codeword length

ii) Final bit rate

iii) Transmission Bandwidth. **(04 Marks)**

OR

10 a. What is quantization? Why it is required in digital communication? Explain symmetric quantizer of mid tread and mid rice type. **(10 Marks)**

b. Draw the line codes for the given binary sequence 01101010

i) Unipolar NRZ

ii) Polar NRZ

iii) Unipolar RZ

iv) Manchester

v) Bipolar RZ signaling. **(10 Marks)**

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21BE45

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Biology for Engineers

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 structure and classification of carbohydrates, focusing on monosaccharide, disaccharides and polysaccharides. Discuss their biomedical importance of carbohydrates. **(10 Marks)**

b. Explain the construction, properties and importance of cellulose-based water filters. **(05 Marks)**

c. Discuss the properties, engineering applications and environmental impact of pHA and PLA as bioplastics. **(05 Marks)**

OR

2 a. Discuss the importance and potential applications of DNA and vaccines using rabies as an example. Explain how DNA vaccines work. **(10 Marks)**

b. Explain the properties, advantages and engineering applications of RNA vaccines, specifically for COVID-19. **(05 Marks)**

c. Discuss the benefits and uses of plant-based proteins as alternatives to animal-based proteins. **(05 Marks)**

Module-2

3 a. Compare and write architecture of the human brain as a CPU system with that based on their characteristics. **(10 Marks)**

b. What is EEG? Write the application of EEG. **(05 Marks)**

c. Eye act as camera. Explain with diagram. **(05 Marks)**

OR

4 a. Describe the architecture of the heart as a pump system. Discuss the function of each chamber. **(10 Marks)**

b. Discuss the reasons for blockages in blood vessels and their implications for cardiovascular health. **(05 Marks)**

c. Discuss the different shapes, materials, coating and expansion mechanisms used in stent design. **(05 Marks)**

Module-3

5 a. Explain the architecture of the lungs as a purification system. Discuss the different parts of the respiratory system and their role in filtering harmful substances and facilitating gas exchange. **(10 Marks)**

b. Discuss the principle and working of spirometry as a diagnostic test for evaluating lung function. Explain how spirometry results can be interpreted and used in the diagnosis of lung conditions. **(05 Marks)**

c. Explain the concept of abnormal lung physiology. Focusing on Chronic Abstractive Pulmonary Disease (COPD) as an example. **(05 Marks)**

OR

6 a. Describe the architecture of the kidney and its functional units. Known as nephrons. Discuss the role of each component of the nephron in the filtration, reabsorption and scoretion processes. **(10 Marks)**

b. Discuss the types of muscle and contract of muscle. **(05 Marks)**

c. Explore the bioengineering solutions being developed for osteoporosis. **(05 Marks)**

Module-4

7 a. Explain the working principle of ultrasonography and discuss its advantages and limitations in medical imaging. **(10 Marks)**

b. Discuss the history of technological echolocation. **(05 Marks)**

c. Explain components of bionic leaf. **(05 Marks)**

OR

8 a. Compare between Birds and Aircrafts with GPS technology for Navigation and discuss. **(10 Marks)**

b. Discuss the principle of super hydrophobic surfaces. **(05 Marks)**

c. Discuss the materials and examples of self cleaning surface. **(05 Marks)**

Module-5

9 a. Elucidate the difference between 3D printer and Bioprinter. **(10 Marks)**

b. Discuss technological importance of 3D printing of Human Ear. **(05 Marks)**

c. Discuss materials used in 3D printing of Bone. **(05 Marks)**

OR

10 a. Evaluate the importance of 3D printing in the food industry. **(10 Marks)**

b. Discuss the technological importance of self healing bio concrete. **(05 Marks)**

c. Evaluate the advantages of bioremediation and biomining. **(05 Marks)**

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18ES51

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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.	Define management. Explain management functions.	(10 Marks)
	b.	Differentiate between management and administration.	(05 Marks)
	c.	Explain decisional roles of a manager.	(05 Marks)
		OR	
2	a.	Explain steps involved in planning.	(10 Marks)
	b.	Explain steps involved in rational decision making.	(10 Marks)

Module-2

3	a.	Explain various steps involved in selection process.	(10 Marks)
	b.	Explain Maslow's hierarchy theory.	(06 Marks)
	c.	Write a note on span of control.	(04 Marks)
		OR	
4	a.	Explain various principles of organizing.	(10 Marks)
	b.	Explain different methods of establishing the control.	(10 Marks)

Module-3

5	a.	Explain in detail, the social responsibilities of business towards different groups.	(10 Marks)
	b.	Explain in detail business ethics and corporate governance.	(10 Marks)
		OR	
6	a.	Discuss and explain how entrepreneurs are classified.	(10 Marks)
	b.	What are the problems faced by entrepreneur? How can they overcome them?	(10 Marks)

Module-4

7	a.	With a small example, explain contribution of family business in India.	(10 Marks)
	b.	Explain in detail the characteristics of a family-owned business in India.	(10 Marks)
		OR	
8	a.	Explain in detail the importance of creativity and innovation in idea generation.	(10 Marks)
	b.	Explain social and legal feasibilities in a project.	(10 Marks)

Module-5

9	a.	What is the importance of business plan? Explain.	(10 Marks)
	b.	Explain the following: i) Venture capital ii) Angel investing.	(10 Marks)
		OR	
10	a.	What are the challenges and difficulties in starting an enterprise?	(10 Marks)
	b.	What are the advantages and disadvantages of PERT and CPM?	(10 Marks)

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18EC52

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Prove that the sampling of Fourier transform of a sequence x(n) results of N point DFT using which both sequence and the transform can be reconstructed. **(08 Marks)**

b. Find N point DFT of the sequence $x(n) = \cos(n\omega_0)$ where $\omega_0 = \frac{2\pi K_0}{N}$ **(04 Marks)**

c. For $x(n) = \{1, -2, 3, -4, 5, -6\}$, without computing DFT, find

i) $\sum_{k=0}^{5} x(k)$ ii) $x(3)$ iii) $\sum_{k=0}^{5} |x(k)|^2$ iv) $\sum_{k=0}^{5} x(k)(-1)^k$ **(08 Marks)**

OR

2 a. Consider the finite length sequence $x(n) = \delta(n) + 2\delta(n-5)$

i) Find the 10 point DFT of x(n)

ii) Find the sequence that has a DFT $y(k) = e^{\frac{j6\pi k}{10}} \times (k)$, where x(k) is the 10 point DFT of x(n)

iii) Find the 10 point sequence y(n) that has a DFT y(k) = x(k)w(k) where x(k) is the 10 point DFT of x(n) and w(k) is the 10 point DFT of w(n) given by w(n) = u(n) – (n – 7) **(12 Marks)**

b. Find the energy of 4 point sequence

$x(n) = \sin\left(\frac{2\pi}{N} n\right), 0 \le n \le 3.$ **(04 Marks)**

c. The 4 point DFT of a real sequence x(n) is x(k) (1, j, 1, –j). Using the properties of DFT, find the DFT of following sequence:

i) $x_1(n) = (-1)^n x(n)$ ii) $x_2(n) = x(4-n)$ **(04 Marks)**

Module-2

3 a. A long sequence x(n) is filtered through a filter with impulse response h(n) to yield output y(n). If input $x(n) = \{1, 0, 1, -2, 1, 2, 3, -1, 0, 2\}$ and $h(n) = \{1, -1, 2\}$, compute y(n) using overlap save technique, Use 6 point circular convolution. **(08 Marks)**

b. Find 8 point DFT of x(n) = n + 1 using DIT-FFT without computing DFT of y(n), find y(k) of $y(n) = x((-n))_8$. **(12 Marks)**

OR

4 a. Determine the output of an LTI system using circular convolution for $x(n) = \{1, 1\}$, $h(n) = \{1, 0, 1\}$. **(03 Marks)**

b. For 512 point DFT/FFT computation , determine

i) Number of complex multiplications and complex additions in DFT and FFT computation

ii) Speed improvement factor

iii) Number of real multiplications and additions in DFT computation

iv) Number of stages and butterflies needed in FFT computation **(07 Marks)**

c. Find the circular convolution of the sequence x(n) = (2, 3, 2, 2), y(n) = (1, 1, 5, 3) using DIF-FFT algorithm. Verify the same using time domain approach. **(10 Marks)**

Module-3

5 a. Convent the lattice structure of FIR filter defined by K1 = 0.65, K2 = 0.341, K3 = 0.8 to direct form structure. Draw both lattice and direct form structure. **(10 Marks)**

b. Design a FIR BPF for lower cutoff frequency 2 rad/s upper cutoff frequency 3rad/s and m = 7. Use Hamming windows. Find frequency response and H(z). **(10 Marks)**

OR

6 a. Design a linear phase HPF using Hanning window for the following desired frequency response $H(w) = \begin{cases} e^{-j5w} & \frac{\pi}{4} \le |w| \le \pi \\ 0 & |w| \le \frac{\pi}{4} \end{cases}$ **(08 Marks)**

b. Obtain the cascade realization of
$H(z) = (1 + 2z^{-1} + 5z^{-2} + 5z^{-3} + 2z^{-4} + z^{-5})(2 + z^{-1} + 3z^{-2})$ **(04 Marks)**

c. Determine the coefficient h(n) of linear phase FIR filter of length m = 15 which has a symmetric unit impulse response and a frequency response that satisfies
$H_r\left(\frac{2\pi k}{15}\right) = \begin{cases} 1 & K = 0,1,2,3 \\ 0 & K = 4,5,6,7 \end{cases}$ **(08 Marks)**

Module-4

7 a. Let $H(s) \frac{1}{s^2+s+1}$ represent the transfer function of low pass filter with passband of 1rad/sec. Use frequency transformation to find the transfer function of i) HPF with passband edge frequency of 100 rad/sec ii) BPF with pass band of 10rad/sec and a center frequency of 100 rad/s **(04 Marks)**

b. Design a second order digital BPF Butterworth filter with the following specifications Butterworth filter with the following specifications
i) Upper cutoff frequency = 2.6KHz
ii) Lower cutoff frequency = 2.4KHz
iii) Sampling frequency = 8000Hz **(08 Marks)**

c. Find DF-I and DF-II realization of
$H(z) = \frac{8z^3 - 4z^2 + 11z - 2}{\left(z - \frac{1}{4}\right)\left(z^2 - z + \frac{1}{2}\right)}$ **(08 Marks)**

OR

8 a. Design a digital IIR Butterworth HPF with frequency specification given by
i) Monotonic passband with cutoff frequency 1000Hz
ii) Monotonic stopband with edge frequency 350Hz
iii) Stopband attenuation ≥ 10dB
iv) Sampling rate 5KHz **(08 Marks)**

b. Obtain DF-I and DF-II realization for
$y(n) = 0.75\, y(n-1) - 0.125\, y(n-2) + 6x(n) + 7x(n-1) + x(n-2)$. **(08 Marks)**

c. Discuss how analog filter is mapped on to digital filter using Bilinear Transformation and comment on its stability. **(04 Marks)**

Module-5

9 a. Explain the basic architecture of TMS320C3X floating point DSP. (08 Marks)

b. Given the FIR filter with passband and gain of 2 and input being half of the range develop the DSP implementation equations in Q15 fixed point system

$y(n) = -0.36\,x(n) + 1.6x(n-1) + 0.36\,x(n-2)$ (06 Marks)

c. With block diagram, explain DSP processors based on Hardvard architecture. (06 Marks)

OR

10 a. Discuss briefly the following special Digital signal processor hardware units

i) Multiplier and Accumulator unit

ii) Address generators (08 Marks)

b. Explain the basic architecture of TMS320C54X family DSP with neat diagram. (08 Marks)

c. i) Find the signed Q15 representation for the decimal number -0.160123

ii) Convert -2.5 to 1EEE single precision format. (04 Marks)

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18EC53

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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 a neat circuit diagram and waveforms explain the working of switching modulator used for generation of amplitude modulated waves. **(08 Marks)**

b. With a neat block diagram, explain the working of COSTAS receiver used for demodulation of DSB-SC signals. **(07 Marks)**

c. Explain the necessary block diagrams, quadrature carrier multiplexing and de-multiplexing system. **(05 Marks)**

OR

2 a. Explain the generation of DSB – SC signals using ring modulator. **(07 Marks)**

b. Explain the scheme of generation and demodulation of USB signals with relevant block

c. diagrams and mathematical equations. **(08 Marks)**

Explain the concept of frequency division multiplexing with suitable block diagram. **(05 Marks)**

Module-2

3 a. Derive the equation of FM wave. Also mention the important properties of angle modulated waves. **(08 Marks)**

b. Obtain the time domain expression of NBFM plot its spectrum and compare with AM what is the inference? **(08 Marks)**

c. An angle modulated signal is give by $s(t) = 10\cos[2\pi \times 10^6 t + 0.2 \sin(2000\pi t)]$ volts determine :

i) Power in the modulated signal for a load of 100Ω
ii) Frequency deviation
iii) Phase deviation
iv) Approximate transmission BW. **(04 Marks)**

OR

4 a. With a neat diagram and relevant equations, explain the non linear model of PLL used for demodulation of FM systems. **(08 Marks)**

b. Discuss the non linear effects in FM systems. **(06 Marks)**

c. With relevant block diagrams, explain FM stereo multiplexing and de-multiplexing technique. **(06 Marks)**

Module-3

5 a. Define : i) Thermal noise ii) Shot noise iii) White noise. **(06 Marks)**

b. Define noise equivalent bandwidth and derive the expression for the same. **(06 Marks)**

c. Derive the expression for the figure of merit for a DSB – SC receiver using coherent detection. **(08 Marks)**

OR

6 a. Derive the expression for the figure of merit for a FM receiver under the influence of noise. **(10 Marks)**

b. Explain pre-emphasis and de-emphasis in FM system. **(05 Marks)**

c. An FM reciver operating with a sinusoidal wave and 80% modulation has an output SNR of 30dB. Calculate the corresponding carrier to noise ratio. **(05 Marks)**

Module-4

7 a. Mention the advantages of digitizing analog signals. **(05 Marks)**

b. State and explain sampling theorem for law-pass signals and derive the interpolation formula. **(10 Marks)**

c. With a neat block diagram, explain the operation of Time Division Multiplexing (TDM). **(05 Marks)**

OR

8 a. With a neat block diagram and waveforms explain the generation of PPM signal. Also mention the benefits of PPM. **(10 Marks)**

b. What is aperture effect in PAM systems? How it can be minimized. **(04 Marks)**

c. Determine the Nyquist rate and Nyquist interval for :

i) $x(t) = 3\cos(50\pi t) + 10\sin(300\pi t) + \cos(100\pi t)$

ii) $x(t) = \frac{1}{2\pi}[\cos(4000\pi t) \cdot \cos(1000\pi t)]$. **(06 Marks)**

Module-5

9 a. With proper block diagrams, explain the PCM system. **(08 Marks)**

b. A PCM system uses a uniform quantizer followed by a N bit encoder. Show that the rms signal to quantization noise is approximately given by (1.8 + 6N)dB. **(08 Marks)**

c. A PCM system uses a uniform quantizer and produces a binary output. The input signal amplitude varies between ± 4V and having average power of 40mW. Calculate the number of bits required for a SNR of 20dB. **(04 Marks)**

OR

10 a. Explain Delta modulation with relevant equations. **(05 Marks)**

b. Explain the channel vocoder with a neat block diagram [LP voice coder]. **(05 Marks)**

c. Represent the binary data 1 0 1 1 0 0 1 0 using :

i) Unipolar NRZ coding
ii) Polar NRZ coding
iii) Unipolar RZ coding
iv) Manchester coding
v) Bipolar RZ coding. **(10 Marks)**

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18EC54

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Information Theory and Coding

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive an expression for average information content of symbols in long independent sequences. **(04 Marks)**

b. Find the relationship between Hartleys, nats and bits. **(06 Marks)**

c. For the Markov source of Fig. Q1 (c), find
(i) Entropy of each state.
(ii) Entropy of the source.
(iii) G_1, G_2. Also show that $G_1 > G_2 > H(s)$. **(10 Marks)**

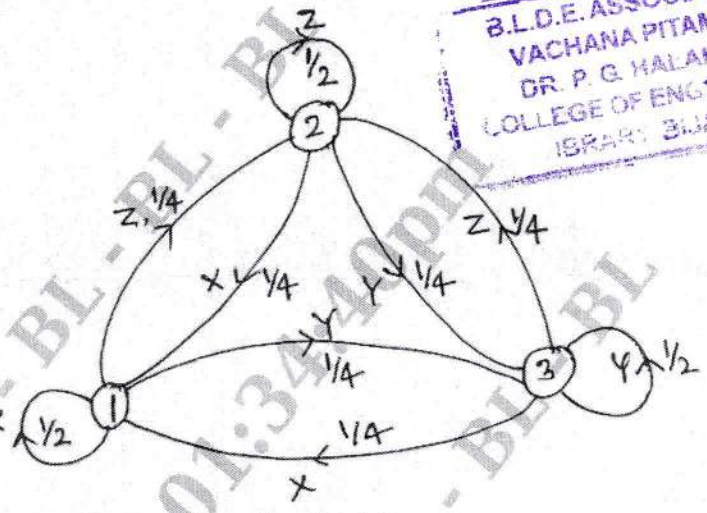

Fig. Q1 (c)

OR

2 a. A binary source is emitting an independent sequence of 0's and 1's . With probabilities 'P' and '1 – P' respectively. Plot the entropy of the source versus 'P'. **(04 Marks)**

b. A code is composed of dots and dashes. Assuming that a dash is 3 times as long as a dot and has one-third the probability of occurrence, calculate
(i) The information in a dot and a dash.
(ii) The entropy of dot-dash code.
(iii) The average rate of information if a dot lasts for 10 m-sec and this time is allowed between symbols. **(08 Marks)**

c. Consider the state diagram of Markov source of Fig. Q2 (c).
(i) Compute the state probabilities
(ii) Find entropy of each state.
(iii) Find the entropy of the source. **(08 Marks)**

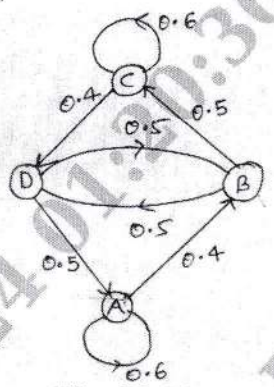

Fig. Q2 (c)

Module-2

3 a. Apply Shannon's encoding (binary) algorithm to the following set of messages and obtain code efficiency and redundancy.

m_1	m_2	m_3	m_4	m_5
$\frac{1}{8}$	$\frac{1}{16}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{3}{8}$

(10 Marks)

b. A discrete memoryless source has an alphabet of seven symbols with probabilities for its output, as described below.

Symbol	S_0	S_1	S_2	S_3	S_4	S_5	S_6
Probability	0.25	0.25	0.125	0.125	0.125	0.0625	0.0625

Compute Shannon-Fano code for this source. Find coding efficiency. **(10 Marks)**

OR

4 a. Consider a zero-memory source with
$S = \{S_1, S_2, S_3, S_4, S_5, S_6, S_7\}$, $P = \{0.4, 0.2, 0.1, 0.1, 0.1, 0.05, 0.05\}$
(i) Construct a binary Huffman code by placing the composite symbol as low as possible. Find the coding efficiency.
(ii) Repeat (i) by moving the composite symbol as high as possible and find the coding efficiency. **(12 Marks)**

b. Explain the properties of codes. Also draw the code-property circle diagram. **(08 Marks)**

Module-3

5 a. A binary symmetric channel has the following noise matrix with source probabilities of $P(X_1) = \frac{2}{3}$ and $P(X_2) = \frac{1}{3}$,

$$p\left(\frac{Y}{X}\right) = \begin{bmatrix} \frac{3}{4} & \frac{1}{4} \\ \frac{1}{4} & \frac{3}{4} \end{bmatrix}$$

(i) Determine H(x), H(y), H(x, y), H(Y/X), H(X/Y) and I(X, Y).
(ii) Find the channel capacity.
(iii) Find channel efficiency and redundancy. **(08 Marks)**

b. What is mutual information? Explain its properties. **(06 Marks)**

c. Consider the Binary Symmetric channel with channel matrix given by,

$$p\left(\frac{Y}{X}\right)=\begin{bmatrix}\frac{3}{4} & \frac{1}{4}\\ \frac{1}{4} & \frac{3}{4}\end{bmatrix}$$

Find the channel capacity using Muroga's method. **(06 Marks)**

OR

6 a. Explain the following :
(i) Symmetric / Uniform channels.
(ii) Binary symmetric channels.
(iii) Binary Erasure channels. **(06 Marks)**

b. An analog signal has a 4 kHz bandwidth. The signal is sampled at 2.5 times the Nyquist rate and each sample quatized into 256 equally likely levels. Assume that the successive samples are statistically independent.
(i) Find the information rate of this source.
(ii) Can the output of this source be transmitted without errors over Gaussian channel of bandwidth 50 kHz and the signal to noise ratio (SNR) of 20 dB?
(iii) If the output of this source is to be transmitted without errors over an analog channel having (S/N) of 10 dB, compute the bandwidth requirement of the channel. **(08 Marks)**

c. State Shannon-Hartley law. Explain the implications of Shannon-Hartley law. **(06 Marks)**

Module-4

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

b. For a systematic (6, 3) Linear Block Code, $G=\begin{bmatrix}1 & 0 & 0 & 1 & 0 & 1\\ 0 & 1 & 0 & 0 & 1 & 1\\ 0 & 0 & 1 & 1 & 1 & 0\end{bmatrix}$

(i) Find all the code vectors.
(ii) Draw the encoder circuit.
(iii) Find minimum distance. **(08 Marks)**

c. For a systematic (7, 4) Linear Block Code, the parity matrix 'P' is given as,

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

(i) Draw the encoder circuit.
(ii) A single error has occurred in each of these received vectors. Detect and correct errors.
(a) $R_A=[0111110]$
(b) $R_B=[1011100]$ **(06 Marks)**

OR

8 a. The parity checkbits of a (7, 4) Hamming code are generated by,

$C_5 = d_1 + d_3 + d_4$

$C_6 = d_1 + d_2 + d_3$

$C_7 = d_2 + d_3 + d_4$

where d_1, d_2, d_3 and d_4 are message bits.

(i) Find the generator matrix 'G' and the parity check matrix 'H' of this code.
(ii) Draw the syndrome calculation circuit for this code.
(iii) Check for $GH^T = 0$ **(08 Marks)**

b. A (15, 5) linear cyclic code has generator polynomial $g(x) = 1 + x + x^2 + x^4 + x^5 + x^8 + x^{10}$,

(i) Draw the encoder for this code.
(ii) Tabulate the contents of shift registers of the encoder for the message polynomial, $D(x) = 1 + x^2 + x^4$ **(06 Marks)**

c. Design an encoder for the (7, 4) cyclic code generated by $g(x) = 1+x+x^3$ and verify its operation using the message vectors (1 0 0 1) and (1 0 1 1). **(06 Marks)**

Module-5

9 a. Consider the (3, 1, 2) convolutional code with $g^{(1)} = (1\ 1\ 0)$, $g^{(2)} = (1\ 0\ 1)$ and $g^{(3)} = (1\ 1\ 1)$.

(i) Draw the encoder block diagram.
(ii) Find the generator matrix.
(iii) Find the code word corresponding to the information sequence (1 1 1 0 1) using time-domain and transform-domain approach. **(12 Marks)**

b. For the (2, 1, 2) convolutional encoder, described by $g^{(1)} = (1\ 1\ 1)$ and $g^{(2)} = (1\ 0\ 1)$,

(i) Draw the encoder circuit.
(ii) Find the generator matrix.
(iii) Find the output sequence for the information sequence d = 1 0 0 1 1 using time domain and transform-domain approach. **(08 Marks)**

OR

10 a. For the (2, 1, 2) convolutional encoder described by $g^{(1)} = (1\ 1\ 1)$ and $g^{(2)} = (1\ 0\ 1)$,

(i) Draw the state table.
(ii) Write the state transition table.
(iii) Draw the state diagram. **(06 Marks)**

b. For the (3, 1, 2) convolutional encoder, with $g^{(1)} = (1\ 1\ 0)$, $g^{(2)} = (1\ 0\ 1)$ and $g^{(3)} = (1\ 1\ 1)$.

(i) Draw state table, state transition table and state diagram.
(ii) Construct the code-tree and find the output sequence for the message sequence (1 1 1 0 1) **(14 Marks)**

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18EC55

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Electromagnetic Waves

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive the expression for electric field intensity due to finite line charge. **(08 Marks)**

b. Derive the relation between $\vec{D}$ and $\vec{E}$. **(04 Marks)**

c. Determine the force exerted on Q_2 by Q_1, if the charges are located : $Q_1 = 3 \times 10^{-4}$C at M(1, 2, 3) and $Q_2 = -10 \times 10^{-4}$ at N(2, 0, 5) in a vaccum. **(08 Marks)**

OR

2 a. State Coulomb's law and prove the expression for electric field intensity due to several charge. **(08 Marks)**

b. Derive the expression for the force due to several charges. **(04 Marks)**

c. A charge Q_1 = 25nC is located at A(4, –2, 7) and a charge Q_2 = 60nC is located at B(–3, 4, –2). Find $\vec{E}$ at C(1, 2, 3). Also find the direction of electric field. Given $\epsilon_0 = 8.854 \times 10^{-12}$F/m. **(08 Marks)**

Module-2

3 a. State and prove divergence theorem. **(06 Marks)**

b. Determine the volume charge density, if the field $\vec{D} = \frac{10\cos\theta\sin\phi}{r} a\hat{r}$ c/m^2. **(07 Marks)**

c. Calculate the divergence of $\vec{D}$ at specified points if $\vec{D} = \frac{1}{Z^2}[10xyz]a\hat{x} + 5x^2z a\hat{y} + (2z^3 - 5x^2y)a\hat{z}$ at P(–2, 3, 5). **(07 Marks)**

OR

4 a. Derive the expression for equation of continuity. **(05 Marks)**

b. Give the relation between $\vec{E}$ and V. **(05 Marks)**

c. Given potential field, $V = 2x^2y - 5z$ and a point (–4, 3, 6) find several numerical values at P

i) Potential V ii) $\vec{E}$ and the direction iii) $\vec{D}$ iv) ρ_v. **(10 Marks)**

Module-3

5 a. Derive the expression for Poisson's equation. **(05 Marks)**

b. Determine whether the pontifical field $V = x^2 - y^2 + z^2$ satisfy the laplace equation. **(05 Marks)**

c. Given vector $\vec{E} = (12yx^2 - 6z^2x)a\hat{x} + (4x^3 + 18zy^2)a\hat{y} + (6y^3 - 6zx^2)a\hat{z}$ check whether it represents a possible electric field. **(10 Marks)**

OR

6 a. State and prove Ampers circuit low. **(08 Marks)**

b. Explain the concepts of scalar and vector magnetic potential. **(06 Marks)**

c. Given : $\overline{H} = [y\cos(\alpha x)\hat{a}x + (y + e^{x})\hat{a}z]$. Find current density vector over the yz plane. **(06 Marks)**

Module-4

7 a. Derive the expression for force on differential current element. **(08 Marks)**

b. Define magnetization and Magnetic moment. **(04 Marks)**

c. Two differential current elements,

$I_1 dL_1 = 3\times10^{-6} a\hat{y}$ Am at $P_1(1, 0, 0)$ and

$I_2 dL_2 = 3\times10^{-6}(-0.5a\hat{x} + 0.4\hat{y} + 0.3a\hat{z})$Am at $P_2(2, 2, 2)$ are located in a free space. Find the vector force exerted on I_2dL_2 by I_1dL_1. **(08 Marks)**

OR

8 a. State and explain Lorentz force equation. **(08 Marks)**

b. Define Magnetic pole strength and Magnetic field intensity. **(04 Marks)**

c. A point charge Q = 18nC has a velocity of 5×10^{6}m/s in the direction :

$\vec{a} = 0.6a\hat{x} + 0.75a\hat{y} + 0.3a\hat{z}$. Calculate the magnitude of the force exerted on the charge by the field :

i) $\vec{B} = -3a\hat{x} + 4a\hat{y} + 6a\hat{z}$ MT

ii) $\vec{E} = -3a\hat{x} + 4a\hat{y} + 6a\hat{z}$ KV/m

ii) $\vec{B}$ and $\vec{E}$ acting together. **(08 Marks)**

Module-5

9 a. Write a Maxwell's equations in point form and integral form. **(06 Marks)**

b. Find the frequency at which conduction current density and displacement current density are equal in a medium with $\sigma = 2 \times 10^{4}$℧/m and $\varepsilon_r = 81$. **(06 Marks)**

c. A circular cross section conductor of radius 1.5mm carries a current $i = 5.5\sin(4 \times 10^{10t})\mu$A. Find the magnitude of displacement current density if $\sigma = 35$℧/m and $\varepsilon_r = 10$. **(08 Marks)**

OR

10 a. Derive the expression for uniform plane wave for a free space. **(08 Marks)**

b. State and prove Poynting theorem. **(06 Marks)**

c. The magnetic field intensity of a uniform plane wave in air is 20/m in $\overline{ay}$ direction. The wave is propagating in $\overline{az}$ direction at an angular frequency of 2×10^{9}rad/s. Find

i) Phase shift constant

ii) Frequency

iii) Wave length

iv) Amplitude of electric field intensity. **(06 Marks)**

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18EC56

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Discuss different levels of abstraction for describing a verilog HDL design, write the example in each case. **(10 Marks)**

b. Design a D-Flip Flop with synchronous reset, taking D-Flip Flop as an instance design a T-Flip flop also write a stimulus to verify the same. **(10 Marks)**

OR

2 a. Explain the typical design flow with verilog HDL for designing VLSI IC. **(08 Marks)**

b. What is a instance and instantiation? Explain with the help of an suitable example. **(06 Marks)**

c. Compare Top-down and Bottom-up design methodology. **(06 Marks)**

Module-2

3 a. Write a verilog code to implement the sequential circuit shown below Fig. Q3 (a), write the stimulus for the same. **(08 Marks)**

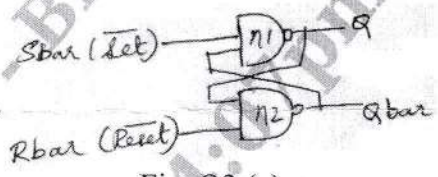

Fig. Q3 (a)

b. With a generated example, explain the component of verilog module. **(08 Marks)**

c. Explain : (i) 'define and (ii) 'include statements. **(04 Marks)**

OR

4 a. Explain the system tasks in verilog with example each:
(i) Nets (ii) Registers (iii) Array (iv) Parameter **(08 Marks)**

b. Define the following data type with an example. **(08 Marks)**

c. List in order the different signal strengths in verilog HDL. **(04 Marks)**

Module-3

5 a. Design a 4 : 1 Mux using primitives in verilog and write the logical diagram, Truth table, end logical expression for 4 : 1 mux. **(08 Marks)**

b. Discuss about (i) Rise (ii) Fall (iii) Turn-off delays. Also explain how their values are assumed when a (i) Single (ii) 2 (iii) 3 values are assigned to them in a statement. **(08 Marks)**

c. Design a gate level module for circuit shown below Q5 (c). **(04 Marks)**

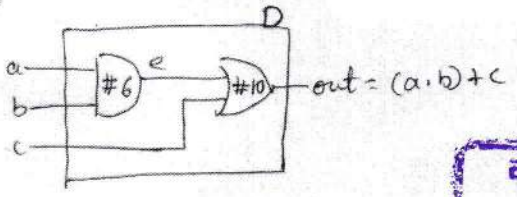

Fig. Q5 (c)

OR

6 a. Develop a gate level verilog code for a 4-bit ripple carry adder from 1-bit full adder. Write a stimulus to verify the design. **(08 Marks)**

b. With the help of a logic diagram and truth table explain bufif 0, bufif 1, notif 0, notif 1 gates. **(06 Marks)**

c. Write the truth table for all 1-bit operators. **(06 Marks)**

Module-4

7 a. With one suitable example, explain the non blocking statements. **(10 Marks)**

b. Explain : (i) Regular delay control (ii) Intra-assignment delay control (iii) Zero delay control. **(06 Marks)**

c. Write a short note on automatic tasks and function. **(04 Marks)**

OR

8 a. Discuss with suitable examples, sequential and parallel blocks. **(08 Marks)**

b. Explain the following loops with suitable syntax and example :
(i) For loop (ii) Repeat loop (iii) While loop (iv) Forever loop **(08 Marks)**

c. List the differences between Tasks and Functions. **(04 Marks)**

Module-5

9 a. Write a short note on : (i) File output (ii) Initializing memory file. **(10 Marks)**

b. Explain the synthesis process if 4-bit magnitude comparator (which includes : Design specification, RTL description, Technology library, design constraints, logic synthesis) (Only stepwise description of the synthesis no diagram or program required) **(10 Marks)**

OR

10 a. Using the primitive gates, design a 1-bit full adder FA. Instantiate the full adder inside. Stimulus module. Force the sum output to a&b&cin for the time between 15 and 35 units. **(10 Marks)**

b. With a neat flow diagram, explain the process of computer aided logic synthesis. **(05 Marks)**

c. With the proper example describe and interpret the following verilog construct :
(i) always statement
(ii) function statement **(05 Marks)**

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21EC51

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Derive the expression for error probability of binary phase shift keying using coherent detection. **(08 Marks)**

b. An FSK system transmits binary data at the rate of 2×10^6 bit per sec. During the source of transmission, AWGN of zero mean and two sided power spectral density 10^{-20}W/Hz is added to the signal. The amplitude of received wave for digit 1 or 0 is 1 microvolt. Determine the average probability of symbol error assuming non-coherent detection. **(06 Marks)**

c. Explain the concept of M-ary PSK. **(06 Marks)**

OR

2 a. With a neat block diagram, explain non-coherent detection of binary FSK technique. **(08 Marks)**

b. Binary data is transmitted over AWGN channel using BPSK at a rate of 1Mbps. It is desired to have average probability of error $p_e \leq 10^{-4}$. Noise PSD = 10^{-12}W/Hz. Determine the average carrier power required at receiver input if the detector is of coherent type. [Assume erfc (3.5) = 0.00025]. **(06 Marks)**

c. Explain the generation and detection of DPSK with neat block diagram. **(06 Marks)**

Module-2

3 a. Explain the geometric representation of set of in energy signals as combination of N orthonormal basis function. Illustrate the case of N = 2 and M = 3 with necessary diagrams and expressions. **(08 Marks)**

b. Explain the correlation receiver using coherent detection. **(06 Marks)**

c. Explain the design of band limited signals with controller ISI-partial response signal. **(06 Marks)**

OR

4 a. Using Gram-Schmidt orthogonalization procedure find the set of orthonormal basis function to represent the signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ as shown in Fig.Q.4(a). Also express each of these signals interms of set of basis function.

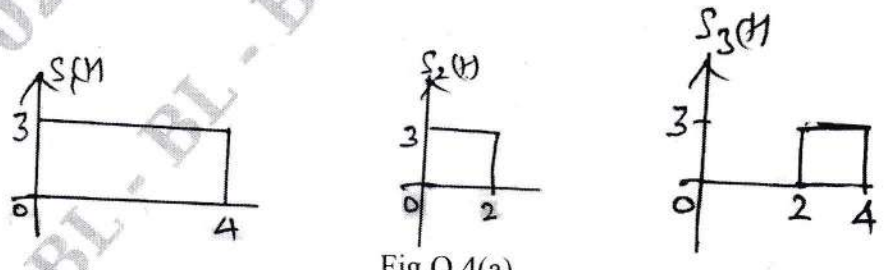

Fig.Q.4(a)

b. State and prove Nyquist condition for zero ISI. **(10 Marks)**

(10 Marks)

Module-3

5 a. Explain the model of spread spectrum digital communication system. **(10 Marks)**

b. With a neat block diagram, explain the CDMA system band on IS-95. **(10 Marks)**

OR

6 a. Explain the frequency hopped spread spectrum technique with neat transmitter and receiver block diagram. **(08 Marks)**

b. The SNR required at the detector to achieve reliable communication in a DSSS communication system is 13dB. If the interference to signal power at the receiver is 20dB. Determine the processing gain required. **(04 Marks)**

c. Write a note on application of DS spread spectrum systems. **(08 Marks)**

Module-4

7 a. Define the following with respect to information theory :

i) Self information
ii) Entropy
iii) Source efficiency
iv) Rate of information. **(08 Marks)**

b. Construct binary code for the following source using Shannon's binary encoding procedure. $s = \{s_1, s_2, s_3, s_4, s_5\}$ $p = \{0.4, 0.25, 0.15, 0.12, 0.08\}$. **(08 Marks)**

c. Explain the types of methods of controlling error. **(04 Marks)**

OR

8 a. Six messages symbols with probability of 0.4, 0.2, 0.2, 0.1, 0.07, 0.03, construct a binary code by using Shannon's Fano encoding procedure. Also determine code efficiency and redundancy. **(10 Marks)**

b. A source produces 5 symbols with probabilities of 0.1, 0.3, 0.4, 0.12 and 0.08.

i) Construct a binary Huffman code
ii) Determine efficiency and redundancy of the code
iii) Draw code-tree. **(10 Marks)**

Module-5

9 a. A (7, 4) linear block code having partly matrix $P = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}$

i) Find all possible code vector
ii) Draw the encoding circuit
iii) Draw the syndrome circuit. **(10 Marks)**

b. A (3, 1, 2) convolutional code with $g^{(1)} = (110)$, $g^{(2)} = (101)$ and $g^{(3)} = (111)$.

i) Draw the encoder block diagram.
ii) Find the generator matrix.
iii) Find the code word for information sequence (11101) using transform domain approach. **(10 Marks)**

OR

10 a. For a (2, 1, 4) convolutional encoder as shown in Fig.Q.10(a). **(10 Marks)**

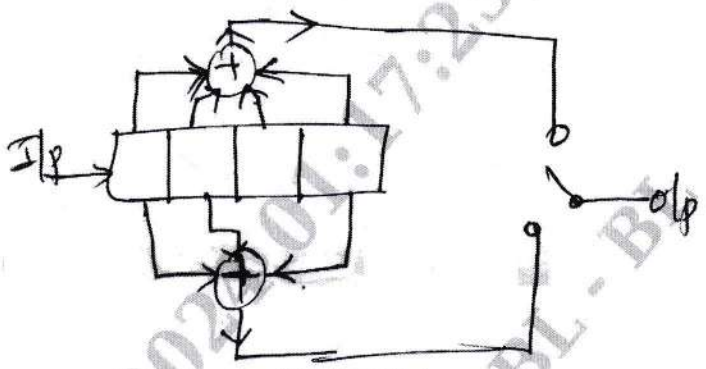

Fig.Q.10(a)

Find the codeward corresponding to the information source (10111). Using time domain and transform domain approach. **(10 Marks)**

b. A, (2, 1, 2) binary convolutional encoder as shown in Fig.Q.10(b). Draw the state table, state transition table, state diagram and corresponding code tree, for the message 10111. Find the encoded sequence.

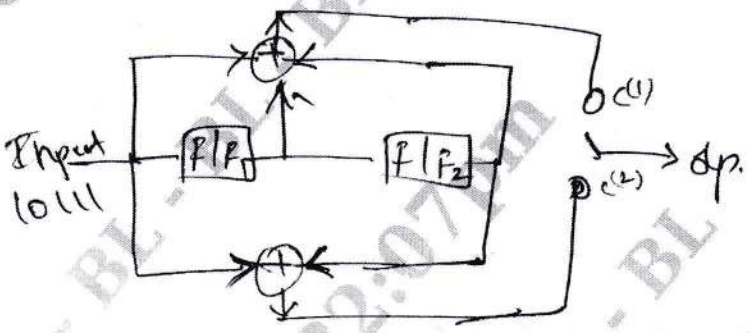

Fig.Q.10(b)

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21EC52

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Computer Organization and Arm Microcontrollers

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, discuss the operational concepts in a computer highlighting the role of PC, MAR, MDR and IR. **(10 Marks)**

b. Explain system software functions in computer. **(06 Marks)**

c. Explain computer basic performance equation. **(04 Marks)**

OR

2 a. Explain operation of DMA with neat diagram. **(10 Marks)**

b. With a neat diagram, discuss implementation of interrupt priority using individual request and acknowledge lines. **(06 Marks)**

c. Illustrate with a neat diagram, a computer using different interface standards. **(04 Marks)**

Module-2

3 a. With a neat diagram, explain the internal organization of 16 × 8 memory chip. **(10 Marks)**

b. State and explain the types of read only memory and memory hierarchy. **(10 Marks)**

OR

4 a. With a neat diagram, explain the three bus organization of a datapath. **(10 Marks)**

b. Explain basic idea of pipelining and 4-stage pipeline structure. **(10 Marks)**

Module-3

5 a. With a neat diagram, explain the four main hardware components of an ARM based embedded device. **(08 Marks)**

b. Discuss ARM design philosophy. **(06 Marks)**

c. Explain the factors that make ARM instruction set suitable for embedded applications. **(06 Marks)**

OR

6 a. Explain ARM core data flow model with a neat diagram. **(08 Marks)**

b. Explain the different processor modes provided by ARM7. **(06 Marks)**

c. Discuss with a neat diagram:
i) Von Neumann architecture with cache
ii) Harvard architecture with TCM. **(06 Marks)**

Module-4

7 a. Explain with neat diagram, barrel shifter operation in ARM processor. **(08 Marks)**

b. Explain with an example the concept of semaphore using swap instruction. **(06 Marks)**

c. Develop an assembly language program to multiply two 16-bit numbers. **(06 Marks)**

OR

8 a. Explain the following with example:
i) MSR ii) MVN iii) TST iv) BIC. **(08 Marks)**

b. Explain with an example forward and backward branch. **(06 Marks)**

c. Develop an assembly language program to find GCD of two numbers using conditional execution. **(06 Marks)**

Module-5

9 a. Discuss with an example code density in thumb instruction set over ARM. **(08 Marks)**

b. Explain ARM-thumb interworking. **(06 Marks)**

c. Explain with example thumb stack operations. **(06 Marks)**

OR

10 a. Explain with an example the effect of using 'char' and 'short' as local variable types in ARM processor. **(08 Marks)**

b. List the C compiler data type mapping for an ARM target with their implementation. **(05 Marks)**

c. With an example, compare the efficiencies of signed int and unsigned int with an example. **(07 Marks)**

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21EC53

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Computer Communication Networks

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Outline the functions of various layers in TCP/IP with necessary diagram to show logical connection between layers. **(10 Marks)**

b. Compare various physical topologies in a computer network. **(10 Marks)**

OR

2 a. Explain five components of data communication with a neat diagram. **(06 Marks)**

b. Explain different types of data-flow with a neat diagram. **(06 Marks)**

c. Explain different types of switched networks used in computer network with relevant diagram. **(08 Marks)**

Module-2

3 a. Explain character-oriented framing and bit-oriented framing with an example. **(10 Marks)**

b. With a neat diagram, explain standard Ethernet frame format. **(10 Marks)**

OR

4 a. With a neat flow diagram and timing diagram, explain CSMA/CD. **(10 Marks)**

b. A pure ALOHA network transmits 200 bit frames on a shared channel of 200 kbps, what is the through put if the system produces (all stations together):

(i) 1000 frames per second **(06 Marks)**

(ii) 500 frames per second

(iii) 250 frames per second **(04 Marks)**

c. Explain implementation of standard Ethernet.

Module-3

5 a. Explain classfull addressing in detail. **(06 Marks)**

b. Explain with neat diagram, the various services provided by network layer. **(10 Marks)**

c. Explain datagram approach, with connectionless service. **(04 Marks)**

OR

6 a. Explain datagram format with neat diagram. **(10 Marks)**

b. Explain the operation of DHCP with neat diagram, also draw the FSM for the DHCP client. **(10 Marks)**

Module-4

7 a. Explain stop and wait protocol in flow diagram with neat diagram. **(10 Marks)**
b. Explain connectionless and connection oriented protocols in transport layer. **(10 Marks)**

OR

8 a. Explain Go-back-N protocol, along with sliding window diagrams. **(10 Marks)**
b. Explain Time-line diagram for a common scenario. **(10 Marks)**

Module-5

9 a. With neat diagram, explain the logical connection at the application layer. **(10 Marks)**
b. Explain the formats of the request and response message. **(06 Marks)**
c. Explain FTP with a neat diagram. **(04 Marks)**

OR

10 a. Explain about electronic-mail architecture. **(10 Marks)**
b. Explain DNS Resolution and its types: (i) recursive resolution and (ii) iteration resolution. **(10 Marks)**

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21EC54

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Electromagnetic Waves

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 explain coulomb's law of force between two point charges in vector form. **(06 Marks)**

b. Convert point P(1, 3, 5) to cylindrical and spherical co-ordinates. Also write the equations for differential surface, differential volume for rectangular, cylindrical and spherical systems. **(06 Marks)**

c. Find electric field intensity at P(1, 1, 1) caused by 4 identical 3nc charges are located at $P_1(1, 1, 0)$, $P_2(-1, 1, 0)$, $P_3(-1, -1, 0)$ and $P_4(1, -1, 0)$. **(08 Marks)**

OR

2 a. Define electric field intensity. Derive an expression for electric field intensity due to infinite line charge. **(08 Marks)**

b. A point charge of 50nc each are located at A(1, 0, 0), B(-1, 0, 0), C(0, 1, 0) and D(0, -1, 0) in free space. Find the total force on the charge at A. Also find $\overline{E}$ at A. **(06 Marks)**

c. A uniform line charge ρ_L = 25nc/m lies on the line x = -3m, y = 4m in freespace. Find electric field intensity at a point (2, 3, 15)m. **(06 Marks)**

Module-2

3 a. State and prove Gauss's law. **(06 Marks)**

b. Evaluate both sides of the divergence theorem for the defined plane in which $1 \le x \le 2$, $2 \le y \le 3$, $3 \le z \le 4$, if $\overline{D} = 4x\,\hat{a}_x + 3y^2\,\hat{a}_y + 2z^3\,\hat{a}_z\ c/m^2$. **(10 Marks)**

c. Derive the point form of continuity of current equation. **(04 Marks)**

OR

4 a. Obtain the expression for the work done in moving a point charge in an electric field. **(06 Marks)**

b. Given that the field $\overline{D} = \frac{5\sin\theta\ \cos\phi}{r}\hat{a}_r\ c/m^2$. Find : i) Volume charge density ii) The total electric flux leaving the surface of the spherical volume of radius 2m. **(08 Marks)**

c. Define potential difference. Derive the expression for potential field of a point charge. **(06 Marks)**

Module-3

5 a. State and prove uniqueness theorem. **(08 Marks)**

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

OR

6 a. Solve the Laplace's equation for the potential field in the homogeneous 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 concentric spheres. **(08 Marks)**

b. Derive the expression for magnetic field intensity due to infinite long straight conductor using Biot-Savart's law. **(06 Marks)**

c. Determine whether or not the following potential fields satisfy the Laplace's equation:
i) $V = 2x^2 - 3y^2 + z^2$ ii) $V = r\cos\theta + \phi$ **(06 Marks)**

Module-4

7 a. Derive an expression for Lorentz Force equation. **(06 Marks)**

b. If $\bar{B} = 0.05x\,\hat{a}_y$ Tesla in a material for which $\pi_m = 2.5$, Find: i) μ_r ii) μ iii) $\bar{H}$ iv) $\bar{M}$ v) $\bar{J}$ vi) $\bar{J}_b$. **(08 Marks)**

c. Derive the expression for the force between two differential current elements. **(06 Marks)**

OR

8 a. Derive the expression for the boundary conditions between two magnetic medias. **(10 Marks)**

b. Calculate the magnetization in magnetic material where:
i) $\mu = 1.8 \times 10^5$ H/m and M = 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 μT and $\chi_m = 15$. **(06 Marks)**

c. Briefly explain the forces on magnetic materials. **(04 Marks)**

Module-5

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

b. Given $\bar{E} = E_m \sin(wt - \beta z)\hat{a}_y$ v/m. Find: i) $\bar{D}$ ii) $\bar{B}$ iii) $\bar{H}$. Sketch $\bar{E}$ and $\bar{H}$ at t = 0. **(08 Marks)**

c. Find the frequency at which conduction current density and displacement current density are equal in a medium with $\sigma = 2 \times 10^{-4}$ mho/m and $\epsilon_r = 81$. **(04 Marks)**

OR

10 a. State and prove Poynting theorem. **(08 Marks)**

b. For the given medium $\epsilon = 4 \times 10^{-9}$ F/m and σ = 0, find 'K' so that $\bar{E} = (20y - kt)\hat{a}_x$ v/m and $\bar{H} = (y + 2\times10^6 t)\,\hat{a}_z$ A/m. **(06 Marks)**

c. A uniform plane wave of frequency 10MHz travels in positive direction in a lossy medium with $\epsilon_r = 2.5$, $\mu_r = 4$ and $\sigma = 10^{-3}$ ℧/m. Calculate α, β, γ and η, λ. **(06 Marks)**

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CBCS SCHEME

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18EC62

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Explain the architecture of ARM cortex – M3 process with the help of neat block diagram. **(10 Marks)**

b. Explain Thumb 2 technology. **(05 Marks)**

c. Explain ARM Cortex - M3 program status Register in detail. **(05 Marks)**

OR

2 a. What is stack? Explain the stack operations using PUSH and POP instructions in ARM cortex M3 with the help of neat diagram. **(06 Marks)**

b. Explain the operation modes and privilege levels in cortex M3 process with a neat transition diagram. **(08 Marks)**

c. Describe the memory map of cortex – M3 with neat diagram. **(06 Marks)**

Module-2

3 a. Explain the following instruction with example.

i) ASR ii) SXTH iii) RBIT iv) REV. **(08 Marks)**

b. Write on ALP to add two 6h-bit numbers stored in memory. **(06 Marks)**

c. Write note on barrier instruction in Cortex M3. **(06 Marks)**

OR

4 a. Analyse the following instruction and write the contents of the register after the execution of each instruction. **(08 Marks)**

Assume $R_8 = 0 \times 00000088$ $R_9 = 0 \times 00000006$ and $R_3 = 0 \times 00001111$

i) RSB.W $R_8, R_9, \# 0 \times 10$

ii) ADD R_8, R_9, R_3

iii) BIC.W $R_6, R_8, \# 0 \times 06$

iv) ORR R_8, R_9

b. Explain with price of code to load multiple data into register from memory and store the same in another part of memory. **(06 Marks)**

c. With a diagram, explain the organization of CMSIS and its benefits. **(06 Marks)**

Module-3

5 a. Explain the components of typical embedded system in detail. **(08 Marks)**

b. Write the difference between I2C and SPI communication interface **(06 Marks)**

c. Explain the sequence of operation of Zigbee and Wi, Fi network. **(06 Marks)**

OR

6 a. Explain sequence of operation for communicating with I2C slave device. **(08 Marks)**

b. Write the difference between RISC and CISC processors. **(06 Marks)**

c. Compare the operation of Bluetooth and Infrared. **(06 Marks)**

Module-4

7 a. What is hardware, Software co-design? Explain the fundamental issues in hardware software co-design. **(10 Marks)**

b. What is non-operational quality attribute? Explain the important non-operational any Embedded system design. **(10 Marks)**

OR

8 a. Explain high level language based embedded firmware development technique. List the advantages of this technique. **(10 Marks)**

b. What is operational quality attribute? Explain the important operational quality attributes to be considered in any embedded system design. **(10 Marks)**

Module-5

9 a. What is Kernel? What are the different functions handled by real-time Kernel? **(10 Marks)**

b. Three processes with process IDs P1, P2, P3 with estimated completion time 6, 8, 2 millisecond respectively enter the ready queue together. A new process P4 with estimated complication time 4ms enters the 'Ready' queue after 1ms. Assume all the process contains only CPU operation and no I/O operations are involved. Calculate the waiting time and Turn Around Time (TAT) for each process and the average waiting time and Turn Around Time in the SRT scheduling. **(10 Marks)**

OR

10 a. What is Inter Process Communication (IPC)? Give on overview of any two IPC mechanisms adopted by various operating systems. **(10 Marks)**

b. Three processes with process IDs P1, P2, P3 with estimated completion time 4, 6, 5 millisecond and priorities 1, 0, 3 (0-highest priority, 3-lowest priority) respectively enter the ready queue together. A new process P4 with estimated completion time 6ms and priority 2 enters the 'Ready' queue after 5ms. Calculate the waiting time and Time and Turn Around Time (TAT) for each process and the average waiting time and Turn Time (Assuming there is no I/O waiting for the processes) in priority – based scheduling algorithm. **(10 Marks)**

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18EC63

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Microwave and Antennas

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 principle of working of Reflex Klystron. **(08 Marks)**

b. A Reflex Klystron operates at 10GHx with beam voltage 300V , Repeller space = 1mm for $1\frac{3}{4}$ mode . Calculate $P_{R\,max}$ and corresponding repeller voltage for a beam current of 18mA. **(06 Marks)**

c. Explain Microwave system, with the help of neat diagram. **(06 Marks)**

OR

2 a. Define Reflection coefficient and transmission coefficient of a transmission line. Derive and expression for each of them. **(08 Marks)**

b. The input impedance of an antenna is $(73 + j42.5)\Omega$ at 900 MHz. Calculate the voltage standing wave ratio. **(04 Marks)**

c. Mention the characteristics of Smith chart. **(08 Marks)**

Module-2

3 a. State and explain the properties of 'S' matrix. **(08 Marks)**

b. Explain precision type variable attenuator, with a neat sketch. **(06 Marks)**

c. Explain H plane T junction. Derive its 'S' matrix. **(06 Marks)**

OR

4 a. Write the characteristics of Magic Tee. Derive scattering matrix for Magic Tee. **(08 Marks)**

b. Impedance matrix of a simple device is given by $\begin{bmatrix} 4 & 2 \\ 2 & 4 \end{bmatrix}$. Find its scattering matrix. **(08 Marks)**

c. Write a note on Phase shifters. **(04 Marks)**

Module-3

5 a. Explain the construction and field pattern of Microstrip line. **(06 Marks)**

b. Discuss different types of losses in Microstrip line. **(06 Marks)**

c. Define the following with respect to antenna :
i) Directivity ii) Antenna beam efficiency
iii) Field zones iv) Effective aperture. **(08 Marks)**

OR

6 a. Derive the relationship between Maximum effective aperture and Directivity. **(06 Marks)**

b. Show that Maximum effective aperture of a half wave ($\lambda/2$) antenna is $0.13\lambda^2$. **(06 Marks)**

c. Two identical transmitting and receiving antenna with gain of 15dBi at 2.45 GHz are separated by a distance of 3km. If the transmitted power is 20W, then calculate the received power. **(08 Marks)**

Module-4

7 a. Find the directivity of an antenna whose radiation intensity is given by
$U = U_m \cos^4\theta \sin^2\phi\ ,\ 0 \le \theta \le \pi/2\ ,\ 0 \le \phi \le 2\pi$. **(06 Marks)**

b. Derive an expression for the field pattern for 'n' isotropic point sources of same amplitude and phase. **(08 Marks)**

c. Draw the field pattern of a broadside array with number element (n) = 5 and spacing (d) = $\lambda/2$. **(06 Marks)**

OR

8 a. Obtain an expression for the field pattern of two isotropic point sources with equal amplitude and phase. Also plot the field pattern. Assume d = $\lambda/2$. **(08 Marks)**

b. Derive an expression for radiation resistance of short electric dipole. **(08 Marks)**

c. Explain the principle of pattern multiplication. **(04 Marks)**

Module-5

9 a. Derive an expression for far field components of small loop antenna. **(08 Marks)**

b. A Coaxial feed pyramidal horn antenna is designed at 915 MHz with aperture A = 50cm and B = 40cm and horn length from neck to mouth = 27.5cm. Assuming efficiency of 72%. Find approximate gain of the horn antenna. **(06 Marks)**

c. A parabolic dish antenna provides a power gain of 50dB at 10GHz with 70% efficiency. Find i) HPBW ii) FNBW iii) Diameter. **(06 Marks)**

OR

10 a. Explain Yagi – Uda array with the help of neat diagram. **(06 Marks)**

b. A helical antenna with a flat circular ground plane is to be designed to operate in axial mode for a gain of 26dB_i at 5.8 GHz. Calculate i) Diameter of the helix ii) Minimum number of turns. **(08 Marks)**

c. Find the radiation resistance of circular loop antenna of radius 0.32m , Operating at 1MHz. The radius of a wire used is 0.4mm conductivity of the wire is 57 ms/m and $\mu_r = 1$. **(06 Marks)**

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18EC646

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Python Application Programming

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Identify three types of errors encounter in python and also explain the basic building blocks of Python program. **(07 Marks)**

b. Develop Python programs to i) find the area of a rectangle ii) find whether the given number is eve or odd. In both cases accept the input from the user and program must handle non-numeric input gracefully by printing a message and exiting the program. **(08 Marks)**

c. Predict the output and justify your answer :
i) –15%7 ii) 7.7//6 iii) (200 – 70) * 10/5 iv) 6 *1 ** 3 v) not "True". **(05 Marks)**

OR

2 a. Write a user defined function named 'solve' that returns the remainder and quotient as division of two numbers accepted from the user print the remainder and quotient separately on the console. **(05 Marks)**

b. Make use of necessary example and flow chart to explain the concept of alternate execution, chained conditional and nested conditional and nested conditional statements. **(08 Marks)**

c. Make use of necessary code snippets to explain :
i) Short circuit evaluation
ii) Type conversion function
iii) Void functions. **(07 Marks)**

Module-2

3 a. Mention the advantages of break and continue statement. Write a program to compute the sum of only odd numbers within the given natural number using continue statement. **(08 Marks)**

b. Make use of necessary syntax and examples to explain the following string methods :
i) lower ii) capitalize iii) join iv) isalpha **(08 Marks)**

c. Use find and string slicing to extract the second half of the email address in the following string and print the result – "From support @ vtu.ac.in July 9 2022". **(04 Marks)**

OR

4 a. Write a Python program to accept the file from the user add :
i) Display the first N-lines of the file
ii) Find the frequency of occurrence of the word accepted from the user in the file **(10 Marks)**

b. Develop a Python program to search for the line that starts with the word "From" in a file. **(05 Marks)**

c. Explain 'for' loop with necessary syntax. Write a program to compute the factorial of a number accepted from the user. **(05 Marks)**

Module-3

5 a. Identify the ways of traversing a list. Explain with example. Also explain any two list operations. **(08 Marks)**

b. Compare and contrast tuples with lists. Explain the following operations in tuple :
i) Sum of tuples
ii) slicing operations
iii) tuple assignment. **(06 Marks)**

c. Write a program using lists to store and display the average of N integers accepts from the user. **(06 Marks)**

OR

6 a. Develop a program that accepts a sentence and builds dictionary with LETTERS, DIGITS, UPPERCASE, LOWERCASE and key values and their count in the sequence as values.
Example :
Sentence = "VTU@123.e - Learning" d = {LETTERS" : 12, "DIGITS" : 3, "UPPERCASE" : 4, "LOWERCAE" : 8}. **(06 Marks)**

b. Write a Python program to check the validity of a passward read by the users. The following criteria should be used to check the validity. Passward should have atleast
i) One upper case letter
ii) One lower case latter
iii) One digit
iv) One special character from ($ # ! @)
v) Eight characters. **(08 Marks)**

c. Demonstrate :
i) The difference between pop and remove methods on lists
ii) How a dictionary item can be represented as a list of tuples. **(06 Marks)**

Module-4

7 a. Differentiate between pure function and modifier develop a Python program to find duration of an event of start and end time is given by defining class TIME. **(08 Marks)**

b. What is polymorphism? Explain with snippet code. **(07 Marks)**

c. Explain init and str method with example. **(05 Marks)**

OR

8 a. Write a Python program that has a class point with attributes as X and Y co-ordinates. Create two objects of this class and find the midpoint of both the points. Also add a method reflux – X to class point, which returns the new point which is the reflection of the point about the X-axis.
Example : Point (5, 10) ⇒ Reflex – X returns point (5, 10). **(08 Marks)**

b. Make use of necessary example to explain single, multiple, multilevel and hierarchical inheritance. **(08 Marks)**

c. Demonstrate the concept of operator overloading with a code snippet. **(04 Marks)**

Module-5

9 a. Make use of an example to explain the significance of XML over the web development. **(08 Marks)**

b. Explain any two socket functions. Write a Python program to that makes a connection to a web server and follows the rules of HTTP protocol to request a document and display what server sends back. **(08 Marks)**

c. What is service oriented architecture? List the advantages of the same. **(04 Marks)**

OR

10 a. Create a simple spidering program that will go through Twitter accounts and build a database of them. **(08 Marks)**

b. With necessary diagram and code describe creation of database table using database cursor architecture. **(08 Marks)**

c. Compare the contrast the Javascript object Notation (JSON) and XML. **(04 Marks)**

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18EC655

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Basic 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. Explain nMOS Fabrication process with necessary diagrams. **(12 Marks)**

b. Explain the Depletion mode nMOS transistor characteristics. **(08 Marks)**

OR

2 a. Describe CMOS P - well fabrication process with necessary diagrams. **(12 Marks)**

b. Explain MOS transistor Trans-conductance g_m and Output conductance g_{ds} . **(08 Marks)**

Module-2

3 a. Explain a simple Bi-CMOS inverter. **(10 Marks)**

b. Explain the calculation of capacitance for simple area and for multilayer. [Refer Fig.Q3(b)]

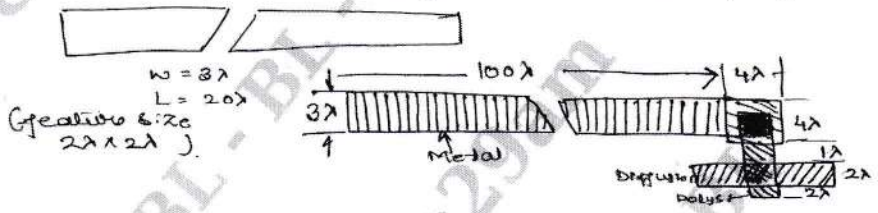

Fig.Q3(b) **(10 Marks)**

OR

4 a. Explain the Estimation of CMOS inverter delay. **(10 Marks)**

b. Explain the transfer characteristics of nMOS inverter. **(10 Marks)**

Module-3

5 a. Draw the circuit schematic and stick diagram of CMOS 2-input NAND gate. **(10 Marks)**

b. Explain briefly λ based design rules for wire and transistor (nMOS, PMOS and CMOS) **(10 Marks)**

OR

6 a. With a neat diagram, explain λ rules for buried and butting contact and show the cross sectional view of same. **(10 Marks)**

b. Explain scaling factors for device parameters. **(10 Marks)**

Module-4

7 a. Explain the GATE (restoring) logic of the inverter (nMOS, CMOS) with circuit symbol, logic and stick diagram. **(10 Marks)**

b. Explain the bus Arbitration logic for structured design with circuit and stick diagram. **(10 Marks)**

OR

8 a. Explain the structured design approach for the implementation of a parity generator. **(10 Marks)**

b. Explain the Dynamic CMOS logic for 3 input NAND gate. **(10 Marks)**

Module-5

9 a. Explain 4-bit Dynamic Shift register (Both nMOS and CMOS). **(10 Marks)**

b. Explain Optimization Technique for CMOS inverter. **(10 Marks)**

OR

10 Explain in detail the general arrangement of 4 bit Arithmetic processor. **(20 Marks)**

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18EC71

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Explain the functions of each layer in TCP/IP protocol suite. **(10 Marks)**
b. Explain the components of a data communication. **(05 Marks)**
c. Illustrate the concept of multiplexing and demultiplexing at the upper three layers of TCP/IP protocol suite. **(05 Marks)**

OR

2 a. Explain four physical topologies of a network. **(10 Marks)**
b. With a neat diagram illustrate the concepts of encapsulation and decapsulation in internet. **(10 Marks)**

Module-2

3 a. Describe the operation of stop and wait protocol with FSM and flow diagram. **(12 Marks)**
b. Define ARP and its position in TCP/IP protocol suite and also explain ARP operation with relevant diagram. **(08 Marks)**

OR

4 a. Explain how collisions are avoided through the use of CSMA/CA's three strategies with flow diagram. **(10 Marks)**
b. Explain briefly 10 Base 5 and 10 Base T implementation. **(06 Marks)**
c. A slotted ALOHA network transmits 200 bit frames using a shared channel with a 200 kbps bandwidth. Find the throughput if the system (all the stations together) produces.
(i) 1000 frames per second
(ii) 500 frames per second
(iii) 250 frames per second **(04 Marks)**

Module-3

5 a. Compare and contrast connectionless packet-switched network with a virtual-circuit packet switched network using necessary diagrams. **(08 Marks)**
b. An organization is granted a block of addresses with beginning address 14.24.74.0/24. The organization needs to have 3 subblocks of addresses to use in its three subnets, one sub-block of 10 addresses, one subblock of 60 addresses and one subblock of 120 addresses. Design the subblocks. **(06 Marks)**
c. Explain MPLS packet, briefly. **(06 Marks)**

OR

6 a. Illustrate IPv4 datagram format. **(10 Marks)**
b. Explain path-vector routing by using spanning tree. Also apply path-vector algorithm for updating path-vectors. **(10 Marks)**

Module-4

7 a. Explain FSMs for Go-Back-N protocol with a neat diagram. **(08 Marks)**

b. Explain the concept of sliding window in circular and linear formats with suitable figures. **(07 Marks)**

c. Explain why the size of the Sender and Receiver windows chosen as one half of 2^m for Selective Repeat Protocol. **(05 Marks)**

OR

8 a. Explain TCP segment format. **(08 Marks)**

b. Illustrate connection establishment in TCP using Three-way handshaking using suitable example. **(07 Marks)**

c. Explain briefly Taho TCP with FSM. **(05 Marks)**

Module-5

9 a. Explain non-persistent connection with suitable example. **(08 Marks)**

b. Explain client-server paradigm with an example. **(06 Marks)**

c. Describe the three Mail Transfer Phases. **(06 Marks)**

OR

10 a. Explain DNS resolution and its type Recursive Resolution. **(07 Marks)**

b. Explain briefly local versus remote lagging in Telnet with a neat diagram. **(07 Marks)**

c. Describe the components of SSH. **(06 Marks)**

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18EC72

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
VLSI Design

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Missing data may be suitably assumed.

Module-1

1 a. Derive an expression for drain current in linear and saturation region. **(08 Marks)**

b. Draw the CMOS inverter circuit and explain its D.C. characteristic. **(08 Marks)**

c. Implement a 2:1 MUX using transmission gate. **(04 Marks)**

OR

2 a. Explain the non ideal IV effect of MOSFET with respect to CMOS channel length modulation and mobility degradation. **(08 Marks)**

b. Explain the operation of nMOS transistor with IV characteristics. **(08 Marks)**

c. Sketch a static CMOS gate computing $y = \overline{(A+B+C)D}$. **(04 Marks)**

Module-2

3 a. Explain CMOS nWell process with necessary diagrams. **(12 Marks)**

b. Mention different types of MOSFET capacitances with necessary diagrams and equations also MOSFET. Capacitances in cut off, linear and saturation region. **(08 Marks)**

OR

4 a. Define scaling. Explain constant field scaling and constant voltage scaling and why constant voltage scaling is usually preferred over full scaling. **(07 Marks)**

b. With neat diagram, explain the Lambda based design rules for two metal layers. **(06 Marks)**

c. Draw the layout for $f = \overline{ABC}$ and estimate the cell area. **(07 Marks)**

Module-3

5 a. Develop the RC delay model to compute the delay of the logic circuit and calculate the delay of unit sized inverter driving another unit in vertex. **(06 Marks)**

b. Estimate t_{pdf} and t_{pdr} for the 3 input NAND gate shown in Fig.Q.5(b) if the output is loaded with h identical NAND gates. **(08 Marks)**

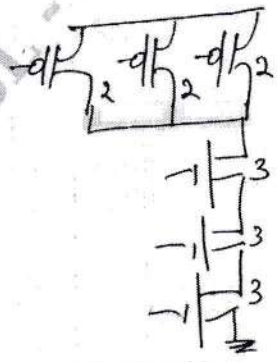


Fig.Q.5(b)

c. Explain eVSL with an example. **(06 Marks)**

100

OR

6 a. Explain: i) Pseudo-nMOS ii) Ganged CMOS with necessary circuit examples. **(06 Marks)**

b. If a unit transistor has R = 10KΩ and e = 0.1fF in a 65nm process, compute the delay, in picoseconds, of the inverter Fig.Q.6(b) with a fan out of h = 4. **(06 Marks)**

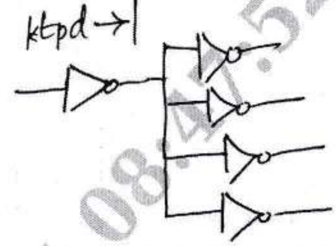


Fig.Q.6(b)

c. Explain linear delay model compare the logical effort of the following gates with the help of schematic diagrams: i) 3-input NAND gate ii) 3 input NOR gate. **(08 Marks)**

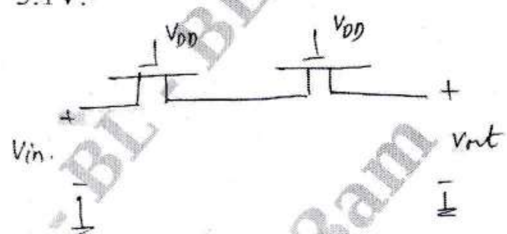
Module-4

7 a. Explain Resettable latches and flipflops using CMOS transmission gate. **(06 Marks)**

b. Explain Dynamic logic. **(06 Marks)**

c. Consider the two nFET chain in Fig.Q.7(c). The power supply is set to a value of V_{DD} = 3.3V and the nFET threshold voltage is V_{Tn} = 0.55V. Find the output voltage V_{out} at the right side of the chain for the following values: i) V_{in} = 2.9V ii) V_{in} = 3.0V iii) V_{in} = 1.4V iv) V_{in} = 3.1V. **(08 Marks)**

Fig.Q.7(c)



OR

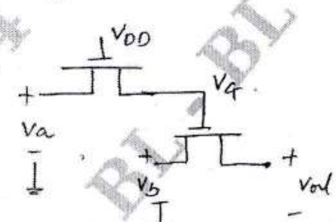
8 a. Explain pulsed latches with schematic and waveforms. **(06 Marks)**

b. The output of an nFET is used to drive the gate of another nFET as shown in Fig.Q.8(b). Assume that V_{DD} = 3.3V and V_{tn} = 0.6V. Find the output voltage V_{out} when the input voltages are at following values:

i) V_a = 3.3V and V_b = 3.3V

ii) V_a = 2.0V and V_b = 2.5V

Fig.Q.8(b)



(08 Marks)

c. Explain Domino logic. **(06 Marks)**

Module-5

9 a. With neat schematic diagram explain the operation of Full CMOS static RAM cell. **(10 Marks)**

b. Explain the different fault models. **(10 Marks)**

OR

10 a. With neat schematic diagram explain the operation of three transistor DRAM cell. **(10 Marks)**

b. Write short notes on: i) Built in Self Test ii) Scan Design. **(10 Marks)**

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18EC733

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Digital Image Processing

Time: 3 hrs. Max. Marks:100

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

Module-1

1 a. Describe the working of sensor strips and discuss the applications in airborne imaging and medical imaging with neat sketches. **(08 Marks)**

b. Define 4, 8 and m connectivity. Compute the lengths of shortest 4, 8 and m paths between the pixels p and q in the image segment shown in Fig.Q1(b) by considering intensity set v = {2, 3,4}.

3	4	1	2
0	1	4	2 (q)
2	2	3	4
3 (p)	0	4	2

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

c. Explain the components of an image processing system with a neat block diagram. **(06 Marks)**

OR

2 a. Describe Ultra Sound (US) imaging with any one example (medical/industry). Also explain the methods of image formation used in US imaging. **(10 Marks)**

b. Demonstrate with experiments, how perceived image quality varies with spatial and gray level resolutions and discuss your observations with a neat graph on NK plane (Isopereference curve). **(10 Marks)**

Module-2

3 a. Explain the following gray level transformations :
i) Gray level slicing
ii) Bit plane slicing. **(08 Marks)**

b. What is meant by histogram matching? Develop a probabilistic model for continuous and discrete functions to demonstrate histogram matching. **(10 Marks)**

c. Discuss local histogram processing. **(02 Marks)**

OR

4 a. Explain image sharpening in the spatial domain using second order derivative filter. (Use Laplacian operator). **(08 Marks)**

b. Determine histogram matched values for the given input image and target histogram as shown in Table Q4(b).

r_i	n_i	$P_z(z_q)$
0	790	0.0
1	1023	0.0
2	850	0.0
3	656	0.15
4	329	0.2
5	245	0.3
6	122	0.2
7	81	0.15

Table Q4(b)

Here $r_i \rightarrow i^{th}$ intensity of input image

$n_i \rightarrow$ number of pixels i^{th} having intensity level.

$P_z(z_e) \rightarrow$ Target histogram

Given $n \rightarrow$ total number of pixels in an input image is 4096. **(12 Marks)**

Module-3

5 a. Define 2D – DFT of an image f(x, y) and its inverse DFT. Also state the following properties of 2D – DFT.

i) Translation
ii) Rotation
iii) Periodicity
iv) 2D convolution. **(08 Marks)**

b. Describe smoothing frequency domain filters, for image enhancement. Also explain the working of following filters for image smoothing in frequency domain :

i) Ideal LPF
ii) Butterworth LPF
iii) Gaussian LPF. **(08 Marks)**

c. Explain selective filtering using band reject filters. **(04 Marks)**

OR

6 a. Explain the basic procedure used for filtering in frequency domain. **(06 Marks)**

b. Explain the working of homomorphic filtering in image processing using mathematical equations and response. **(08 Marks)**

c. State and prove the conjugate symmetry properties of 2D – DFT with respect to an image f(x, y). **(06 Marks)**

Module-4

7 a. Explain the module of the image degradation/restoration process. **(06 Marks)**

b. Describe how the images are restored in the presence of only noise interference. Also explain the following mean filters used for image restoration.

i) Arithmetic mean
ii) Geometric mean
iii) Harmonic mean
iv) Contra harmonic mean. **(10 Marks)**

c. Explain inverse filtering with necessary mathematical equations and examples. **(04 Marks)**

OR

8 a. Explain the following noise Probability Density Functions (PDF) used in image processing.
   i) Gaussian
   ii) Rayleigh
   iii) Gamma
   iv) Exponential
   v) Uniform
   vi) Impulse. **(12 Marks)**

b. What are adoptive filters? Explain adoptive local noise reduction and adoptive median filter with the algorithms. **(08 Marks)**

Module-5

9 a. With a neat sketch, explain color chromaticity diagram. **(08 Marks)**

b. Describe the process of RGB to HSI conversions with mathematical equations. **(06 Marks)**

c. What is meant by mathematical morphology? Explain dilation and erosion operations using mathematical equations. **(06 Marks)**

OR

10 a. Discuss the process of converting HSI to RGB with relevant mathematical expressions. **(10 Marks)**

b. Demonstrate the working operating and closing morphological operations using mathematical equations and real time examples. **(08 Marks)**

c. Write a brief note on Pseudo color image processing. **(02 Marks)**

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18EC741

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
IOT and Wireless Sensor Networks

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. List the entities behind the IOT technology and give examples in each case. **(10 Marks)**

b. Represent the following:
i) Direct and indirect accesses between CoAP client and CoAP server.
ii) CoAP client access for resource using resource directory.
iii) CoAP client and server access using proxies. **(10 Marks)**

OR

2 a. Represent the following:
i) CoAP request or response communication to a machine, IoT device or MT.
ii) A computer or machine interface using IP communication to a mobile service provider.
iii) A machine or IOT device or MO communication of CoAP request or response communication. **(10 Marks)**

b. Write the equations that represent the simple conceptual framework of IOT and complex conceptual framework for IOT using cloud platform based processes and services. **(10 Marks)**

Module-2

3 a. Illustrate the different classes of internet network and for what reason subnet masks are used? **(10 Marks)**

b. Describe the different classification of cloud service models and give the example in each case. **(10 Marks)**

OR

4 a. Show the details of IP packets received or transmitted at or to network layer. **(10 Marks)**

b. Name two open source platform used in the IOT based data collection, storage and computing. Give the reasons for using these platform. **(10 Marks)**

Module-3

5 a. Write the program for Ardecino controlled traffic light control system in which green light is ON towards East-West in the starting. Three traffic lights-Red, Yellow and Green needs to be controlled on each of the north, east, south and west in clockwise pathways. Assume delays 5s each between successive states of LEDS and steady state for 70s for a pair of pathways. **(12 Marks)**

b. Illustrate the layered attacker model and possible attacks using IETF six layer modified model for IOT/M2M. **(08 Marks)**

OR

6 a. Write the programming of Arduino for usages of RFID serial data reading using UART port. Use port 2 and 5 for serial RX and serial TX. **(12 Marks)**

b. Mention the five levels of software development for application and services for IOT/M2M (no need to draw the block diagram and explanation). **(08 Marks)**

Module-4

7 a. Explain any five required mechanisms in case of wireless sensor network. **(10 Marks)**

b. Illustrate the energy consumption in microcontrollers used in WSN. **(10 Marks)**

OR

8 a. State the difference between microcontrollers versus microprocessor, FPGAS and ASICS. **(10 Marks)**

b. What are the 3 types of mobility in WSN scenario and illustrate. **(10 Marks)**

Module-5

9 a. Compare different modulation schemes available in the design of physical layer and transceiver in WSNs. **(10 Marks)**

b. Explain Perkins model of assignment of MAC address in WSN. **(10 Marks)**

OR

10 a. Explain the general concept of geographic routing. **(10 Marks)**

b. Illustrate the S-MAC principle used in the low duty cycle protocols and wakeup concept. **(10 Marks)**

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18EC751

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Communication Theory

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 meant by channel as applied to communication system? Explain different possible channels in a communication system. **(10 Marks)**

b. Derive an expression for free-space propagation path loss and the received signal power. Make suitable assumptions as necessary. **(10 Marks)**

OR

2 a. Explain various mechanism of wave propagation in transmission of radio signals through wireless medium. **(10 Marks)**

b. A wireless transmitter has an output power of 50 W. It is connected to its antenna by a coaxial cable that is 250 mtrs long and is properly matched. The signal attenuation in the coaxial cable is specified as 5 dB/100 m. The transmitting antenna has a gain of 8.5 dBi.

(i) How much power is available to the transmitting antenna?

(ii) Compute the EIRP in the direction of maximum antenna gain.

(iii) Calculate the power density at 1 km away from the transmitting antenna in the direction of maximum antenna gain, assuming free, space propagation. **(10 Marks)**

Module-2

3 a. Describe the types causes and effects of various types of noise which may affect the communication system. **(10 Marks)**

b. Draw AM envelopes for $m_a = 1.0$ and $m_a = 0.5$ and $m_a = 0$. Discuss the effect of change in modulation index on AM envelope. **(10 Marks)**

OR

4 a. Explain the concept of single time frequency modulation with suitable diagrams. **(10 Marks)**

b. Draw the block diagram for an AM super heterodyne receiver and describe its operation and the primary function of each stage. **(10 Marks)**

Module-3

5 a. Compare natural sampling with flat top sampling. **(05 Marks)**

b. Discrete samples of an analog signal are uniformly quantized to PCM. If maximum value analog sample is to be represented with in 0.1% accuracy, find minimum number of binary digits required per sample. **(05 Marks)**

c. Describe briefly the functions of each block in a PCM system. **(10 Marks)**

OR

6 a. Consider a 4 bit PCM coded system. The normalized peak to peak input voltage range is ±16 V for a uniform quantizer. Justify that non uniform quantization would have yielded better results. **(10 Marks)**

b. Explain the generation of PWM signal and demodulation of PWM signal with suitable diagrams. **(10 Marks)**

Module-4

7 a. Explain digital modulation types in detail and also discuss design features. **(10 Marks)**

b. Explain concept of ASK and ASK modulator with suitable diagram. **(10 Marks)**

OR

8 a. State and move shown coding theorem. **(10 Marks)**

b. Explain the objectives of source coding and a typical source coding model with necessary diagram. **(10 Marks)**

Module-5

9 a. Explain the applications of wireless communication in health sector and military operations. **(10 Marks)**

b. Consider that a geographical service area of a cellular system is 4200 km^2. A total of 1001 radio channels are available for handling traffic and the area of the cell to be 12 km^2.

(i) Find how many times would cluster size 7 have to be replicated in order to cover the entire service area.

(ii) Calculate the number of channels per cell and the system capacity.

(iii) If cluster size reduced to 4, calculate the coverage area of cluster. **(10 Marks)**

OR

10 a. Explain the concept of frequency reuse and spectrum efficiency with suitable diagram. **(10 Marks)**

b. Illustrate and prove that for a regular hexagonal geometry, the frequency reuse ratio is $q = \sqrt{3K}$. **(10 Marks)**

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15EC82

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Fiber Optics and Networks

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. What are the advantages of optical fiber communication? **(04 Marks)**

b. Explain the photonic crystal fiber with cross-sectional end view of the structure of an index guiding photonic crystal fiber. **(06 Marks)**

c. A silica fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine:

i) The critical angle in air for the fiber
ii) The numerical aperture for the fiber
iii) The acceptance angle in air for the fiber. **(06 Marks)**

OR

2 a. With suitable structures give comparison of conventional single mode and multi mode step index and graded index optical fibers. **(06 Marks)**

b. Explain briefly about fiber materials used in optical communication. **(06 Marks)**

c. A multimode step index fiber with a core diameter of 80μm and a relative index difference of 1.5% is operating at a wavelength of 0.85μm. If the core refractive index is 1.48. Estimate:

i) The normalized freq. for the fiber
ii) The number of guided modes. **(04 Marks)**

Module-2

3 a. Explain about material absorption losses in an optical fiber. **(06 Marks)**

b. Explain the significance of fiber connector with relevant diagram explain the function of cylindrical ferrule connector. **(06 Marks)**

c. A glass fiber exhibits material dispersion given by $\left|\lambda^2(d^2n_1/d\lambda^2)\right|$ of 0.025. Determine the material dispersion parameter at a wavelength of 0.85μm and estimate the rms pulse broadening per kilometer for a good LED source with an rms spectral width of 20nm in this wavelength. **(04 Marks)**

OR

4 a. Explain the fiber bend loss with relevant diagram and expressions. **(06 Marks)**

b. Explain intermodal dispersion. With suitable diagram show the paths taken by the axial and an extreme meridional ray in a perfect multimode step index fiber. **(06 Marks)**

c. Write a note on fiber splices. **(04 Marks)**

Module-3

5 a. Draw the diagram of a typical GaAlAs double Hetrostructure LED along with energy band diagram and refractive index profile and explain. **(10 Marks)**

b. Explain the terms :
   (i) Spontaneous emission
   (ii) Stimulated emission
   (iii) Quantum efficiency. **(06 Marks)**

OR

6 a. Explain Fabry–Perot resonator cavity of laser with a neat diagram. **(06 Marks)**
b. Briefly discuss the possible sources of noise in optical fiber receiver. **(06 Marks)**
c. A GaAs laser operating at 850nm Los 560μm length and refractive index n = 3.7. What are the frequency and over length spacing's? **(04 Marks)**

Module-4

7 a. Explain the operational principle and implementations of WDM with diagram. **(08 Marks)**
b. Explain polarization independent Isolator with a neat diagram. **(08 Marks)**

OR

8 a. Explain optical circulators and optical add/drop multiplexers in detail. **(06 Marks)**
b. Explain the amplification mechanism in EDFA amplifier with the help of energy band diagram. **(10 Marks)**

Module-5

9 a. Explain public telecommunication network review with neat diagram. **(08 Marks)**
b. Explain an optical packet switched network with neat diagram. **(08 Marks)**

OR

10 a. Explain the concept of optical burst switching. **(08 Marks)**
b. Explain the different types of optical networking node elements. **(08 Marks)**

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15EC831

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Micro Electro Mechanical System

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. With neat block diagrams, explain the components of Microsystems. **(09 Marks)**

b. Compare microsystems and microelectronics technologies. **(07 Marks)**

OR

2 a. From a engineering perspective, list the benefits of miniaturing the engineering devices. **(07 Marks)**

b. Debate on multidisciplinary nature of Microsystems engineering with the help of neat block diagram. **(09 Marks)**

Module-2

3 a. What are principal applications of microsensors, actuators and fluidics? **(08 Marks)**

b. Describe in detail about Acoustic wave sensors and chemical sensors. **(08 Marks)**

OR

4 a. Explain in detail optical sensors and pressure sensors. **(08 Marks)**

b. Describe the four popular actuation techniques for micro devices. Provide atleast major advantages and one disadvantage of each of these techniques. **(08 Marks)**

Module-3

5 a. Determine the maximum stress and deflection in a square plate made of silicon when subjected to a pressure loading, P = 20MPa. The plate has edge length a = 532 μm and thickness h = 13.88μm. Take E = 190,000MPa. **(08 Marks)**

b. Design a micro-accelerometer. **(08 Marks)**

OR

6 a. Determine the minimum thickness of the circular diaphragm of a micro-pressure sensor made of silicon having following conditions.
d = 600μm, applied pressure P = 20 MPa
yield strength of silicon 7000, MPa
E = 190,000MPa V = 0.25. **(08 Marks)**

b. Write a note on thermomechanics. **(08 Marks)**

Module-4

7 a. Explain scaling in electrostatic forces with respect to MEMS. (10 Marks)
b. Define force scaling vector and obtain the scaling factors:
i) Acceleration a
ii) Time t
iii) Power density P/V_0 (06 Marks)

OR

8 a. Obtain the scaling factors in Fluid Mechanics. (10 Marks)
b. Obtain the scaling factors in:
i) Scaling of heat flux
ii) Scaling in thermal conductivity in submicrometer regime (06 Marks)

Module-5

9 a. Describe the DRIE process. How can DRIE achieve virtually perfect vertical etching. (09 Marks)
b. Explain the techniques used in etch stop. (07 Marks)

OR

10 a. Sketch and explain the major fabrication steps in the LIGA process. (07 Marks)
b. Explain the mechanical problems associated with surface micromachining. (09 Marks)

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17EC81

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Wireless Cellular and LTE 4G Broadband

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. List the advantages of OFDM leading to its selection for LTE and explain. **(10 Marks)**

b. Discuss the delay spread and coherence bandwidth with relevant expressions. **(10 Marks)**

OR

2 a. Explain the following in brief :
(i) Pathless and Shadowing.
(ii) Angular Spread and Coherence distance. **(10 Marks)**

b. Explain with a neat diagram adaptive modulation and coding. **(10 Marks)**

Module-2

3 a. With a neat block diagram, explain OFDM communication system. Also mention the need of timing and frequency synchronization. **(10 Marks)**

b. Explain SC-FDMA uplink transmitter with neat diagram. **(10 Marks)**

OR

4 a. Explain spatial diversity of multiple antenna techniques. **(10 Marks)**

b. Explain open-loop MIMO in spatial multiplexing. **(10 Marks)**

Module-3

5 a. Explain the LTE Radio interference protocols. **(10 Marks)**

b. Explain the transport channels in LTE. **(10 Marks)**

OR

6 a. Explain the hierarchical channel structure of LTE. **(10 Marks)**

b. Explain briefly layer mapping and precoding in modulation mapping. **(10 Marks)**

Module-4

7 a. Explain uplink control information. **(10 Marks)**

b. Explain the types of uplink reference signals. **(10 Marks)**

OR

8 a. Briefly explain the function of H-ARQ feedback in downlink and uplink transmission. **(10 Marks)**

b. Explain in brief types of Random Access procedure in LTE. **(10 Marks)**

Module-5

9 a. Explain the main services and functions of PDCP sublayer for the user plane. **(10 Marks)**

b. Explain RRC states and its functions. **(10 Marks)**

OR

10 a. Explain mobility management over the SI transfer. **(10 Marks)**

b. Explain three basic approaches to mitigate ICI in downlink. **(10 Marks)**

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Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024

Wireless and Cellular 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 three basic propagation mechanisms. **(10 Marks)**

b. Discuss about the parameters coherence bandwidth and delay spread. In what way does it effect the wireless channel? **(10 Marks)**

OR

2 a. Explain free space propagation model with necessary equations. **(10 Marks)**

b. Exhibit the difference between fast fading and slow fading channel. **(10 Marks)**

Module-2

3 a. With block diagram, explain the GSM architecture. **(10 Marks)**

b. Explain the GSM hyper frame with TDMA. **(10 Marks)**

OR

4 a. Explain the functions of three layers in a network management subsystem. **(10 Marks)**

b. Explain the dedicated control channels. **(10 Marks)**

Module-3

5 a. With a neat block diagram, explain about CDMA network system architecture. **(10 Marks)**

b. Explain about 3G CDMA. **(10 Marks)**

OR

6 a. Explain about the concept of CDMA channels. **(10 Marks)**

b. Explain about Layer 3 operations. **(10 Marks)**

Module-4

7 a. Explain about channel dependent, multi-resource scheduling and signaling for scheduling in downlink and uplink. **(10 Marks)**

b. With the help of neat diagram, explain how the timing and frequency synchronization is performed by the receiver to demodulate OFDM signal. **(10 Marks)**

OR

8 a. Discuss about flat IP architecture. **(10 Marks)**

b. With a neat diagram, explain SC-FDE. List out the advantages and disadvantages of SC-FDE. **(10 Marks)**

Module-5

9 a. List the advantages of OFDM leading to its selection for LTE and explain. **(10 Marks)**

b. With a neat block diagram of OFDMA down link transmitter and explain the principle of operation. **(10 Marks)**

OR

10 a. With a neat diagram, explain SC-FDMA uplink transmitter. **(10 Marks)**

b. Explain about download link OFDMA radio receivers. **(10 Marks)**

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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.

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18EC822

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Micro Electro Mechanical System

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 block diagram, explain MEMS as micro sensors and microactuators. **(10 Marks)**

b. Explain typical MEMS and Micro System Products (no diagrams required). **(10 Marks)**

OR

2 a. Explain with a neat block diagram, the working principle of intelligent micro system. **(08 Marks)**

b. Explain and mention the application of micro system in the following industries:
(i) Automotive Industry (ii) Health Care Industry
(iii) Aerospace Industry (iv) Telecommunication **(12 Marks)**

Module-2

3 a. Brief the working of biomedical sensor and biosensor. **(10 Marks)**

b. Explain the working of typical micro pressure sensor assembly. **(10 Marks)**

OR

4 a. Define ionization and recombination. **(02 Marks)**

b. Explain the process of electrohydrodynamics with a neat diagram. **(08 Marks)**

c. With a neat diagram, explain how a chemical sensor works. **(10 Marks)**

Module-3

5 a. Derive a formula for estimating the natural frequency of a micro-accelerometer with negligible damping effect. **(10 Marks)**

b. Determine the equivalent spring constant K and natural frequency W_n of a cantilever beam elements in a micro-accelerometer in Fig.Q5(b). The beam is made of silicon with a young's modulus of 190,000 MPa.

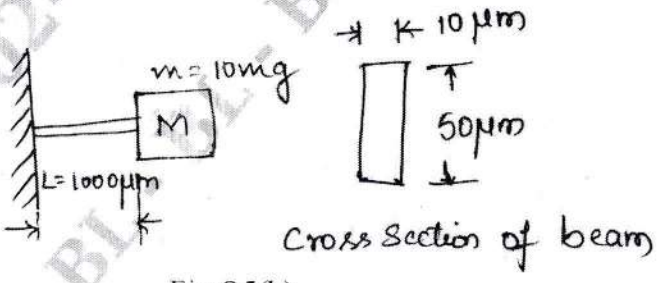

Fig.Q5(b) **(06 Marks)**

c. Derive an expression for bending of circular plates with edge fixed. **(04 Marks)**

OR

6 a. Describe overview of finite element stress analysis. **(10 Marks)**

b. Write short note on Thin-Film mechanics. **(10 Marks)**

Module-4

7 a. Define force scaling vector and obtain the scaling factor:
   (i) Acceleration (a)
   (ii) time (t)
   (iii) Power density P/V_0 **(10 Marks)**

   b. Explain scaling in heat conduction and heat convection. **(10 Marks)**

OR

8 a. Explain scaling factors in fluid mechanics. **(10 Marks)**

   b. Explain scaling in electrostatic forces with respect to MEMS. **(10 Marks)**

Module-5

9 a. Write short note on LIGA process. **(10 Marks)**

   b. Explain the following concepts:
   (i) Electroplating
   (ii) Etch stop **(10 Marks)**

OR

10 a. Describe deep reactive ion etching with neat diagram. **(10 Marks)**

   b. Discuss the problems associated with surface micromachining:
   (i) Adhesion of Layer
   (ii) Stiction **(10 Marks)**

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