B.L.D.E.A's V.P. Dr. P.G. Halakatti College of Enginering and Technology
Vijayapur-586103

Department of Electronics and Communication Engineering

Question Papers Dec.2024/Jan.2025

CBCS SCHEME

USN | | | | | | | | | | | **18EC32**

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
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 terms : (i) Network and Circuit (ii) Active and Passive circuits (iii) Mesh and Loop (iv) Node **(06 Marks)**

b. Reduce the circuit using source transformation technique for the circuit shown in Fig. Q1 (b). **(07 Marks)**

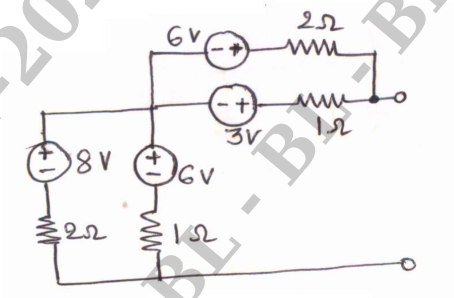


Fig. Q1 (b)

c. Find the voltage across capacitor using mesh analysis for the circuit shown in Fig. Q1 (c). **(07 Marks)**

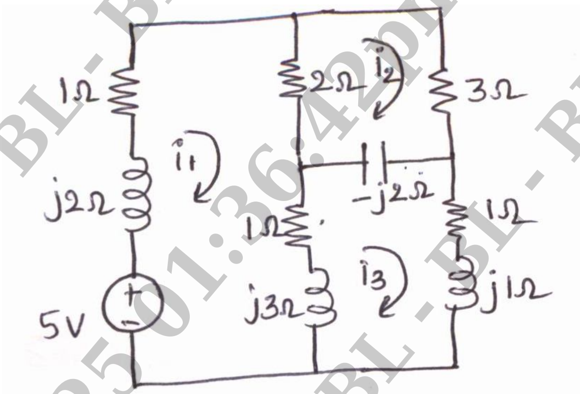


Fig. Q1 (c)

OR

2 a. Derive the expression for, (i) Δ to Y transformation (ii) Y to Δ transformation , Δ - delta, Y - Star **(10 Marks)**

b. Use the nodal analysis to find the value of V_x in the circuit shown in Fig. Q2 (b), such that the current through $(2 + j3)\Omega$ is zero. **(10 Marks)**

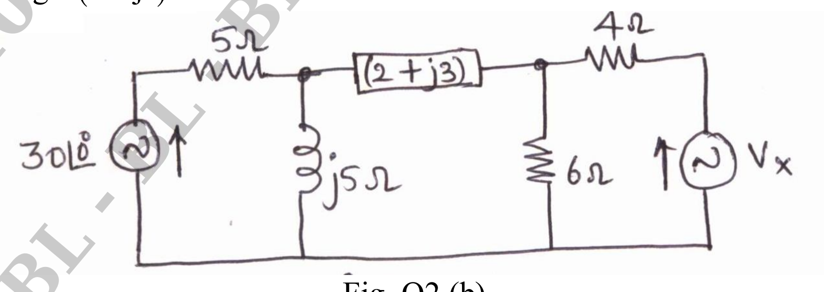


Fig. Q2 (b)

Module-2

3 a. State superposition theorem and hence obtain the response I for the network shown in Fig. Q3 (a).

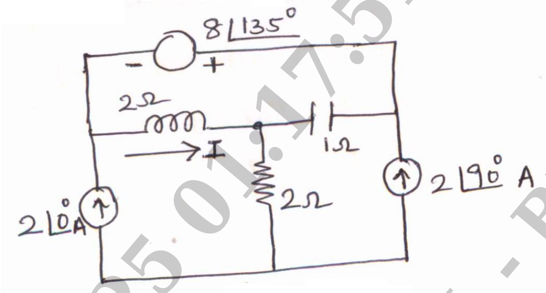


Fig. Q3 (a) **(12 Marks)**

b. State and prove Millman's theorem. **(08 Marks)**

OR

4 a. Obtain the Thevenin's and Norton's Equivalent circuit for the network shown in Fig. Q4 (a).

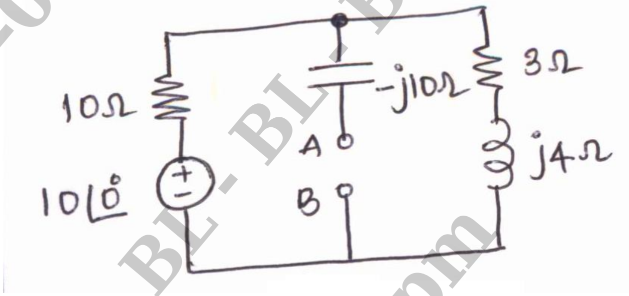


Fig. Q4 (a) **(08 Marks)**

b. State and prove Maximum power transfer theorem for AC circuits. **(06 Marks)**

c. Determine the Norton's Equivalent circuit across AB terminals and hence find current through 5Ω resistor for the network shown in Fig. Q4 (c). **(06 Marks)**

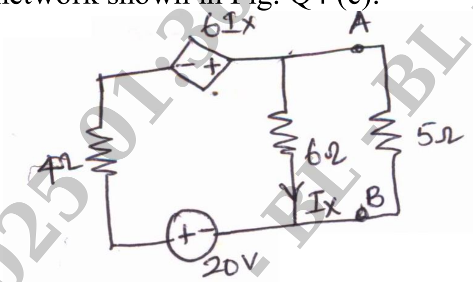


Fig. Q4 (c)

Module-3

5 a. Explain in detail the transient response of a R-L circuit for D.C. Excitation. **(10 Marks)**

b. Find i(t) for the network shown in Fig. Q5 (b), if the switch K is opened at t = 0, assume circuit was in steady state condition before the switch was opened at t = 0. **(10 Marks)**

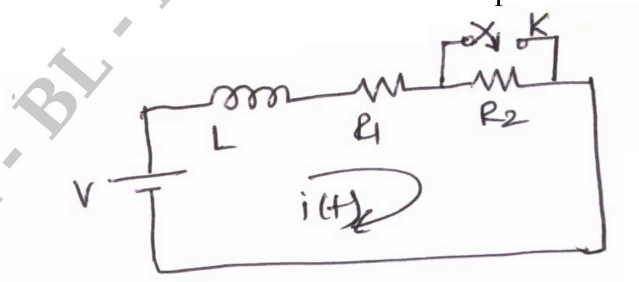


Fig. Q5 (b)

OR

6 a. Explain in detail the transient response of R-C circuit for A.C. Excitation. **(10 Marks)**

b. Determine $i(0^+)$, $\frac{di(0^+)}{dt}$, $\frac{d^2i(0^+)}{dt^2}$ if switch K is closed at t = 0 for the circuit shown in Fig. Q6 (b). Given V = 10 V, R = 10 Ω, L = 1 H, C = 10 μF and $V_C = 0$. **(10 Marks)**

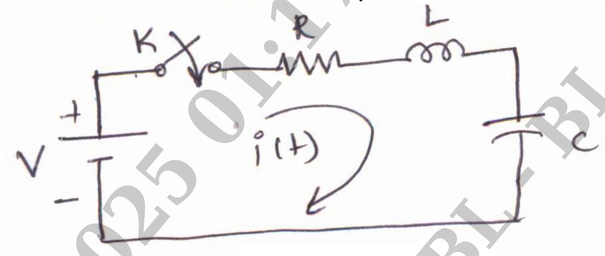


Fig. Q6 (b)

Module-4

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

b. Find the Laplace transform of waveform shown in Fig. Q7 (b). **(10 Marks)**

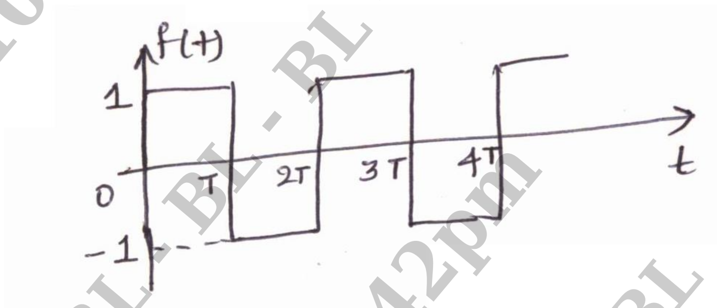


Fig. Q7 (b)

OR

8 a. Obtain the Laplace transform of, (i) Step (ii) Ramp (iii) Sinωt **(10 Marks)**

b. Find the Equivalent impedance of the circuit shown in Fig. Q8 (b), using Laplace transform.

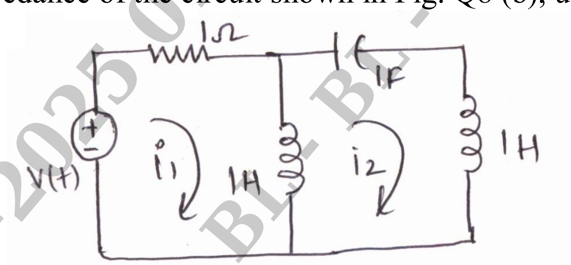


Fig. Q8 (b) **(10 Marks)**

Module-5

9 a. Define resonant frequency, half power frequencies with respect to series circuit and hence show that resonant frequency is geometric mean of half power frequencies. **(08 Marks)**

b. A coil of inductance 10H and 10Ω resistance is connected in parallel with 100 PF capacitor. The combination is applied with a voltage of 100 V. Find resonant frequency and current at resonance. **(06 Marks)**

c. A series RLC circuit consists of a resistance of 1 KΩ and an inductance of 100 mH in series with capacitor of 10 PF. If 100 V is applied as input across the combination determine resonant frequency, Max-current, Q-factor. **(06 Marks)**

OR

10 a. Explain z and y parameters with equivalent circuit and also express z-parameters in terms of y-parameters. **(08 Marks)**

b. Find the transmission parameters for the circuit shown in Fig. Q10 (b).

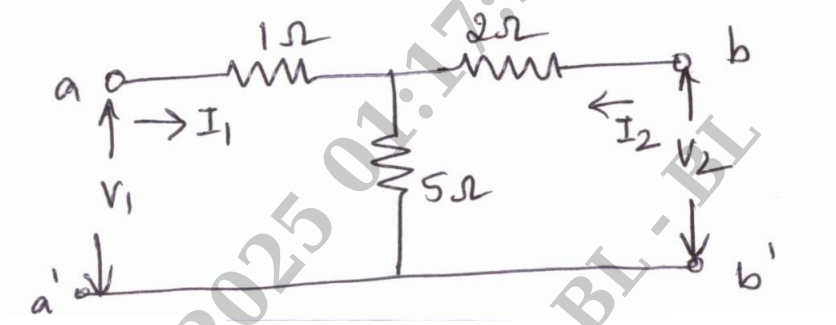


Fig. Q10 (b) **(06 Marks)**

c. Define Q-factor, Selectivity, Bandwidth and hence derive the relation between resonant frequency and half power frequencies. **(06 Marks)**

* * * * *

USN

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
Electronic Devices

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Illustrate the different types of bonding forces in solids with neat diagram. **(10 Marks)**

b. Differentiate between Direct and Indirect semiconductor. **(10 Marks)**

OR

2 a. Explain Electron – Hole pair concept with the help of neat diagram and equations. **(10 Marks)**

b. What is Hall – Effect? With neat diagram, explain how does hall effect works. **(10 Marks)**

Module-2

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

b. Explain Zener breakdown and avalanche breakdown under reverse biased P-N junction with neat diagram. **(10 Marks)**

OR

4 a. Discuss the operation of light emitting diode with neat sketch. **(10 Marks)**

b. How does photodiode works as a photovoltaic cell explain with the help of diagram? **(10 Marks)**

Module-3

5 a. Explain the amplification of a p-n-p transistor with neat diagram. **(10 Marks)**

b. Explain the switching operation of a transistor. Also explain the four operating regimes of transistors. **(10 Marks)**

OR

6 a. Derive as expression for I_c and I_E using Ebers Moll equation and draw its equivalent circuit. **(10 Marks)**

b. Discuss the fabrication process of BJT. **(10 Marks)**

Module-4

7 a. Discuss the Basic n channel pn JFET operation with equivalent circuit and frequency limitation. **(10 Marks)**

b. Explain Ideal capacitance – voltage characteristics of MOSFET. **(10 Marks)**

OR

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

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

Module-5

9 a. With Schematic diagram, explain ION – implantation system. **(08 Marks)**

b. Explain low pressure chemical vapour deposition reactor. **(06 Marks)**

c. Discuss photolithography neat sketch. **(06 Marks)**

OR

10 a. What are the different types of Integrated circuits and its significance? **(10 Marks)**

b. Explain the process of Integration involved in CMOS technology. **(10 Marks)**

* * * * *

CBCS SCHEME

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

18EC34

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
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. With the help of block diagram, explain the general logic design sequence. **(06 Marks)**

b. Place the following Boolean equations in to respective canonical forms

i) $f(abc) = \bar{a}\bar{b} + ac + \bar{b}c$ ii) $f(pqr) = (p + \bar{q})(\bar{q} + r)$ **(06 Marks)**

c. Find the minimal sum for the function using K-map $f(abcd) = \Sigma m(1, 2, 6, 7, 9, 11, 12, 15)$. **(08 Marks)**

OR

2 a. Design a digital circuit for implementing majority of four digital inputs. **(07 Marks)**

b. Simplify the given Boolean expression using K-map

$f(abcd) = \Pi M(1, 2, 3, 4, 9, 10) + \Pi d(0, 14, 15)$ **(05 Marks)**

c. Find the prime implicants of the function using Quine-MuClusley method.

$f(abcd) = \Sigma m(0, 1, 2, 3, 6, 7, 8, 9, 14, 15)$. **(08 Marks)**

Module-2

3 a. Design the full substractor circuit using universal gates. **(10 Marks)**

b. Design 4:16 decoder using two 3:8 decoder. **(10 Marks)**

OR

4 a. Explain the structure of Programmable Logic Array (PLA) with example. **(06 Marks)**

b. Implement $f(pqrs) = \Sigma m(0, 1, 5, 6, 7, 9, 10, 15)$ using 4:1 MUX with p,q as select lines. **(08 Marks)**

c. Implement the following POS function $f(pqr) = \Pi(0, 1, 3, 5)$ using 3:8 decoder with active-high outputs. **(06 Marks)**

Module-3

5 a. What is race around condition? How can it be overcome by MS-JK flip-flop? **(08 Marks)**

b. Define register and explain four bit SISO, SIPO, PISO, PIPO registers. **(12 Marks)**

OR

6 a. Bring out differences between synchronous and a synchronous counters. **(05 Marks)**

b. With the help of output waveforms, explain 3-bit asynchronous counter. **(08 Marks)**

c. Explain the working of twisted ring counter with necessary logic diagram and waveforms. **(07 Marks)**

Module-4

7 a. Design synchronous MOD-7 counter to count from 0 to 6. **(12 Marks)**

b. Sequential circuit has one input and one output. The state diagram of the same is shown in Fig Q7(b). Design sequential circuit using D-flip-flop.

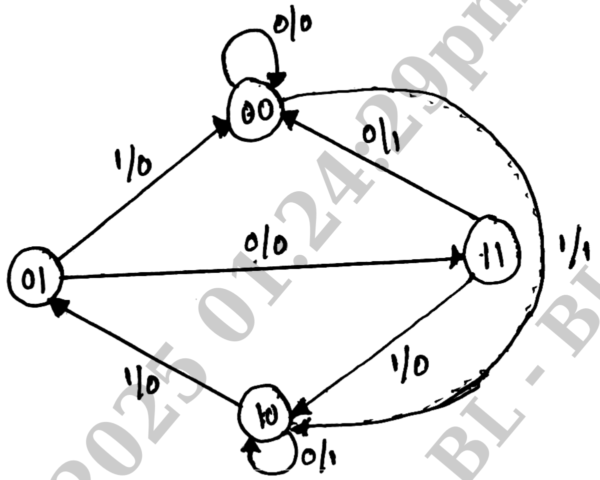


Fig Q7(b) **(08 Marks)**

OR

8 a. Construct the transition table, state table, state diagram for Moore sequential circuit given in Fig Q8(a)

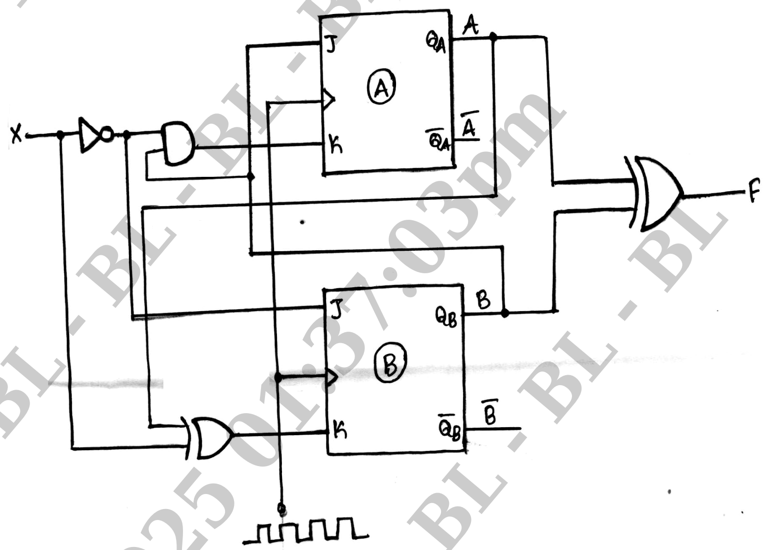


Fig Q8(a) **(10 Marks)**

b. Design a MOD – 6 synchronous counter using D-flipflop for the sequence 0 – 4 – 3 – 5 – 1 – 2 **(10 Marks)**

<u>Module-5</u>

9 a. Design a comparator using iterative circuits. **(10 Marks)**

b. With neat block diagram, explain serial adder with accumulator. **(10 Marks)**

OR

10 a. Design a binary divider circuits. **(10 Marks)**

b. List the guide line for constructions of state graphs. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

18EC35

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
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. Explain the basic operational concept between the processor and memory with a neat block diagram. **(08 Marks)**
b. Explain how to measure the performance of the computer. **(08 Marks)**
c. Write a note on types of computers. **(04 Marks)**

OR

2 a. List out and explain the three systems used for representing signed numbers and also brief about the modular number system concept. **(08 Marks)**
b. Write short notes on Big-endian and little-endian assignment. **(08 Marks)**
c. Write a note on processor clock. **(04 Marks)**

Module-2

3 a. What is addressing mode? Explain any five types of addressing modes with an example. **(10 Marks)**
b. What are assembler directives? Explain about the various directives used in the program with example. **(10 Marks)**

OR

4 a. Explain the concept of stacks and queues. **(08 Marks)**
b. With an example explain shift and rotate instructions. **(08 Marks)**
c. Explain subroutine linage with an example using linkage register. **(04 Marks)**

Module-3

5 a. Showing the possible register configuration in I/O interface, explain program controlled input/output. **(10 Marks)**
b. With a neat diagram, explain DMA controller operation with its interface registers. **(10 Marks)**

OR

6 a. Define exceptions. Explain the different types of exceptions. **(08 Marks)**
b. Explain the registers involved in a DMA interface to illustrate DMA. **(08 Marks)**
c. Explain the concept of vectored interrupt. **(04 Marks)**

Module-4

7 a. With figure, explain internal organization of 2M × 8 dynamic memory chip. **(10 Marks)**

b. Define cache memory. Explain various types with neat diagram. **(10 Marks)**

OR

8 a. Explain with block diagram the operation of SD RAM. **(08 Marks)**

b. What is virtual memory? Explain its organization with neat diagram. **(08 Marks)**

c. Write short notes on magnetic hard disk. **(04 Marks)**

Module-5

9 a. Explain with neat diagram, single bus organization of data path inside a processor. **(10 Marks)**

b. Discuss the organization of hardwired controlled unit. **(10 Marks)**

OR

10 a. With a block diagram, describe the organization of a micro programmed control unit. **(10 Marks)**

b. Explain multiple bus/three bus organization, with a neat diagram. **(10 Marks)**

* * * * *

CBCS SCHEME

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

18EC36

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
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. Interpret the control and gate characteristics of SCR with circuit diagrams and waveforms. **(10 Marks)**

b. Illustrate RC triggering circuits with neat waveforms. **(10 Marks)**

OR

2 a. With a neat circuit diagram explain class A commutation circuit. **(10 Marks)**

b. Summarize U.J.T. triggering **(10 Marks)**

Module-2

3 a. Illustrate with neat diagram and waveform of Bridge controlled rectifiers with R and RL load. **(10 Marks)**

b. Explain step up / down chopper with neat circuit diagram and waveforms. **(10 Marks)**

OR

4 a. Illustrate with neat diagram and waveform of full wave controlled rectifiers with RL load. **(10 Marks)**

b. Explain with neat diagram and waveforms Half wave controlled rectifiers with R and RL load. **(10 Marks)**

Module-3

5 a. Explain discontinuous mode of isolated fly back converter with neat circuit diagram and waveforms. **(10 Marks)**

b. Illustrate with waveforms, full bridge inverter with RL load. **(10 Marks)**

OR

6 a. Explain with neat diagram isolated forward converter. **(10 Marks)**

b. Explain the types of static error. Describe briefly the static characteristics of instrumentation. **(10 Marks)**

Module-4

7 a. Explain successive approximation type DVM. **(10 Marks)**

b. Explain in detail the unbalanced Wheatstone's bridge with neat diagram. **(10 Marks)**

OR

8 a. Explain in detail the unbalanced Wein's bridge with neat diagram. **(10 Marks)**

b. Explain function generator with neat block diagram. **(10 Marks)**

Module-5

9 a. Explain the working of LVDT. **(08 Marks)**

b. Describe the structure and operation of PLC. **(12 Marks)**

OR

10 a. With neat diagram explain Resistance Thermometer. **(08 Marks)**

b. Explain the parameters and advantages of transducers. **(12 Marks)**

* * * * *

CBCS SCHEME

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

21EC34

Third Semester B.E. Degree Examination, June/July 2024
Analog Electronic Circuits

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. Explain the working of voltage-divider bias circuit. **(06 Marks)**

b. Derive the expression for A_v for the MOSFET amplifier circuit. **(06 Marks)**

c. Design the circuit shown in Fig.Q1(c) to establish I_D = 0.5 mA. MOSFET parameters are V_t = 1V, $k_n' W/L$ = 1 mA/V^2 and λ = 0.

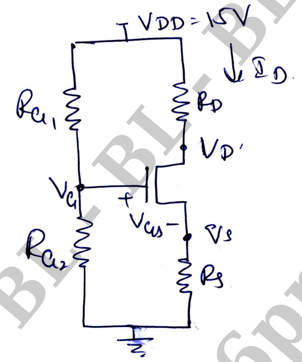


Fig.Q1(c) **(08 Marks)**

OR

2 a. Draw and explain the MOSFET biasing circuit using fixing V_G . **(06 Marks)**

b. Derive the expression for g_m . **(08 Marks)**

c. Consider the amplifier circuit shown in Fig.Q2(c). Let V_{DD} = 5V, V_t = 0.7V ; λ = 0 and k_n = 1 mA/V^2. Find V_{ov} , I_D , R_D and R_G to obtain a voltage gain of 25 and an input resistance of 0.5 MΩ. What is the maximum allowable input signal V_i ? **(06 Marks)**

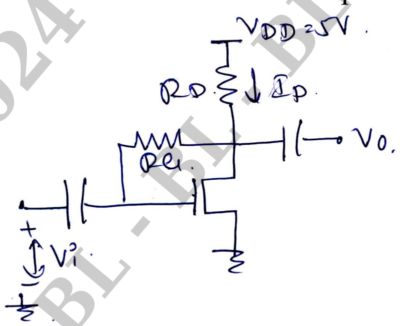


Fig.Q2(c)

Module-2

3 a. Write a note on 3 basic configuration of MOSFET amplifier. Derive the expressions for characterizing parameters of MOSFET amplifier. **(06 Marks)**

b. Draw the high frequency equivalent circuit of a MOSFET and explain the significance of the different elements of the circuit. **(08 Marks)**

c. An amplifier with an input resistance of 100 kΩ an open circuit voltage gain of 100V/V and an output resistance of 100 Ω is connected between a 20 kΩ signal source and a 2 kΩ load. Find the overall voltage gain G_V . **(06 Marks)**

OR

4 a. Derive the expression for characterizing parameters of CS amplifier with source resistance. **(06 Marks)**

b. With a neat diagram, explain the operation of a transistor pierce crystal oscillator. **(08 Marks)**

c. Consider CS amplifier with $I_D = 0.25mA$; $V_{ov} = 0.25$ V, $R_D = 20$ kΩ, $V_A = 50V$, $R_{sig} = 100$ kΩ and $R_L = 20$ K. Find R_{in} , A_{vo} , R_0 , A_o and G_V . If to maintain reasonable linearity the peak of the input sine-wave signal is limited to 10% (2 V_{ov}). What is the peak of the sine wave voltage at the output? **(06 Marks)**

Module-3

5 a. Draw the block diagram of feedback amplifier and discuss the effect of negative feedback with respect to closed loop gain, bandwidth and distortion. **(06 Marks)**

b. How power amplifiers are classified? Discuss them briefly. **(06 Marks)**

c. In an amplifier has a bandwidth of 300 kHz and voltage gain of 100, what will be the new bandwidth and gain if 10% negative feedback is introduced? What will be the gain bandwidth product before and after feedback? What should be the amount of feedback if the bandwidth is to be limited to 800 kHz. **(08 Marks)**

OR

6 a. Explain how negative feedback effects acts on input and output impedance of a circuit. **(06 Marks)**

b. Draw the block diagram of current series feedback amplifier and derive an expression for input resistance, voltage gain and output resistance. **(08 Marks)**

c. Draw the circuit diagram and explain the operation of class B push pull amplifier with relevant waveforms. Show that the maximum conversion efficiency of the class B push pull amplifier is 78.5% **(06 Marks)**

Module-4

7 a. With neat circuit diagram explain the operation of R-2R D/A converter. **(06 Marks)**

b. Draw and explain the working of precision full wave rectifier. **(08 Marks)**

c. Explain the functional block diagram of IC555. **(06 Marks)**

OR

8 a. Write a note on Butterworth approximation. **(06 Marks)**

b. Write a note on monoshot multivibrator using IC555 **(06 Marks)**

c. Design a second order low pass Butterworth filter having high cutoff frequency of 1 kHz. Draw its frequency response. **(08 Marks)**

Module-5

9 a. Define power Electronics and brief its applications. **(06 Marks)**

b. Explain power electronics converters. **(08 Marks)**

c. Explain silicon controlled Rectifier with its characteristics. **(06 Marks)**

OR

10 a. Explain turn on and turn off methods of SCR. **(06 Marks)**

b. Explain gate triggering circuit of RC firing circuit with necessary diagram. **(06 Marks)**

c. With neat waveform and circuit diagram, explain UJT firing circuit. **(08 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

BEC302

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

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.**	Design a combinational logic truth table so that an output is generated indicating when a majority of four inputs is tree.	**4**	**L3**	**CO1**
	b.	Find the prime implicants and the essential prime implicants of the following Boolean functions using Karnaugh maps. i) $f(a, b, c, d) = \Sigma(1, 5, 6, 7, 11, 12, 13, 15)$ ii) $f(a, b, c, d) = \Sigma(0, 1, 4, 5, 9, 11, 13, 15)$	**8**	**L4**	**CO1**
	c.	Simplify the given boolean function using Quine McCluskey minimization technique for the function $O = f(a, b, c, d) = \sum(0, 1, 2, 3, 6, 7, 8, 9, 14, 15)$	**8**	**L3**	**CO1**
		OR			
Q.2	**a.**	Place the following equations into the proper canonical form: i) $P = f(a, b, c) = ab' + ac' + bc$ ii) $G = f(w, x, y, z) = w'x + yz'$	**4**	**L3**	**CO1**
	b.	Find the minimal sum and minimal product for the following Boolean functions using Karnaugh maps i) $f(a,b,c,d) = \bar{a}\bar{b}d + bcd + a\bar{b}d + b\bar{c}\bar{d}$ ii) $f(a,b,c,d) = (a+\bar{b})(a+c+d)(\bar{a}+\bar{b}+\bar{d})(a+\bar{c}+d)$	**8**	**L4**	**CO1**
	c.	Simplify the given boolean function using quine. McCluskey minimization technique for the function. $s = f(a,b,c,d) = \Sigma(1,3,13,15) + \Sigma d(8,9,10,11)$	**8**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	Design and explain binary full adder with block diagram, Karnaugh map and logic circuit.	**10**	**L3**	**CO2**
	b.	Define decoder, write the symbol, truth table and logic circuit for 3:8 line decoder using minterm generator.	**10**	**L2**	**CO2**
		OR			
Q.4	**a.**	Define multiplexer, write the symbol, truthtable and logic circuit for 4:1 multiplexer using enable input.	**10**	**L2**	**CO2**
	b.	Realize the Boolean function $f(w, x, y, z) = \sum(0, 1, 5, 6, 7, 9, 12, 15)$ i) Using 8:1 MUX ii) Using 4:1 MUX	**10**	**L2**	**CO2**

		Module – 3			
Q.5	**a.**	Develop the characteristic equation for i) SR flip flop ii) JK flip flop iii) D flip flop iv) T flip flop.	**10**	**L3**	**CO3**
	b.	Explain serial in, parallel at unidirectional shift register and parallel in serious out unidirectional shift register.	**10**	**L2**	**CO3**
		OR			
Q.6	**a.**	Explain Mod-4 ring counter and Mod-8 twisted ring counter with logic diagram and counting sequence.	**10**	**L2**	**CO3**
	b.	Design a synchronous Mod-6 counter using clocked D-flip flop.	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Explain logical operators and relational operators used in verilog.	**8**	**L2**	**CO4**
	b.	Illustrate i) NETS ii) Register iii) Vector iv) integer data types with an example.	**8**	**L2**	**CO4**
	c.	Write a verilog code for full adder using data flow description style.	**4**	**L2**	**CO4**
		OR			
Q.8	**a.**	Illustrate the structure of behavioural description with an example using half adder.	**8**	**L2**	**CO4**
	b.	Illustrate the structure of verilog module with an example using half subtractor.	**8**	**L2**	**CO4**
	c.	Write a verilog code for binary to gray using behavioural description style.	**4**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Write the syntax of IF and EISE-IF with an example.	**8**	**L2**	**CO4**
	b.	Write logic symbol, flowchart and program for D-latch using behavioural description style.	**8**	**L2**	**CO4**
	c.	Write a verilog code for 8:1 MUX using behavioural description style.	**4**	**L2**	**CO4**
		OR			
Q.10	**a.**	Explain the structure of structural model with built in gates using example of half adder. Also mention an primitive built in gates.	**8**	**L2**	**CO4**
	b.	Write a verilog code of a 3-bit ripple carry adder using structural description model.	**8**	**L2**	**CO4**
	c.	Write a verilog code of SR flip flop using behavioural description style.	**4**	**L2**	**CO4**

* * * * *

CBCS SCHEME

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

BEC303

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

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.	Derive expressions V_{in}, V_{out} and A_Y for a common emitter circuit with ac equivalent circuit with π – model.	12	L1	CO2
	b.	What is the voltage gain and output voltage across the load resistor of V_{DB} amplifier? $R_1 = 10\ k\Omega$, $R_2 = 2.2\ k\Omega$, $R_C = 3.6\ k\Omega$, $R_E = 1\ k\Omega$, $R_L = 10\ k\Omega$, $V_{CC} = 10\ V$, $V_{BE} = 0.7\ V$ and $V_{in} = 2\ mV$.	8	L1	CO1
		OR			
Q.2	a.	With a neat diagram, explain loading effect of input impedence.	10	L1	CO1
	b.	Explain three types of Bias circuit, (i) Emitter feedback bias. (ii) Collector feedback bias and (iii) Collector and emitter feedback.	10	L1	CO1
		Module – 2			
Q.3	a.	Explain the three biasing methods to bias MOS amplifiers with neat circuit diagram.	10	L2	CO2
	b.	Explain the T-equivalent circuit model of MOSFET.	10	L3	CO2
		OR			
Q.4	a.	With a small signal equivalent model of MOSFET, derive an expression of voltage gain and transconductance.	10	L2	CO2
	b.	Explain common source follower and derive the expression of voltage gain with necessary equation.	10	L2	CO2
		Module – 3			
Q.5	a.	Explain R and 2R resistor Digital to Analog converter and also derive the expression of output voltage.	10	L2	CO3
	b.	With a neat circuit diagram, explain the operation of Monostable multivibrator.	10	L2	CO3
		OR			
Q.6	a.	With a neat diagram, explain operation of RC-phase shift oscillator using op-amp. Write the expression for frequency of oscillations.	8	L2	CO3
	b.	With a net diagram, explain operation of crystal oscillator using BJT and Write necessary equations.	6	L2	CO3
	c.	A crystal has these values L = 3 H, C_S = 0.05 PF, R = 2 kΩ and C_m = 10 PF. What are the series and parallel resonant frequencies of the crystal?	6	L3	CO3

Module – 4					
Q.7	**a.**	Explain the first order Low Pass filter with frequency response.	**10**	**L2**	**CO4**
	b.	Explain the two types of Band Pass filters.	**10**	**L2**	**CO4**
OR					
Q.8	**a.**	Explain the four types of Negative feedback circuits.	**10**	**L2**	**CO4**
	b.	Explain the working of 2nd order high pass filter with a neat circuit and frequency response.	**10**	**L2**	**CO4**
Module – 5					
Q.9	**a.**	Explain two load lines with necessary circuit diagram and equations.	**10**	**L2**	**CO5**
	b.	With a neat diagram, explain the working of a Thyristor.	**10**	**L2**	**CO5**
OR					
Q.10	**a.**	Explain Basic Construction and working of IBGTs with necessary figure.	**10**	**L2**	**CO5**
	b.	With a neat diagram, explain the working of UJT relaxation oscillator.	**10**	**L2**	**CO5**

* * * * *

CBCS SCHEME

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

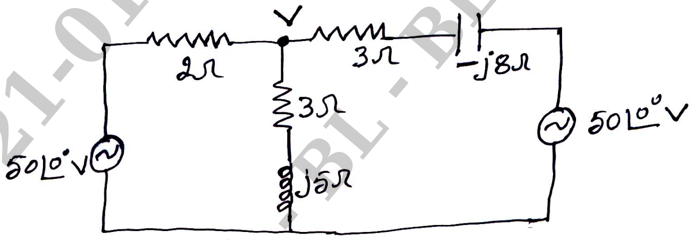
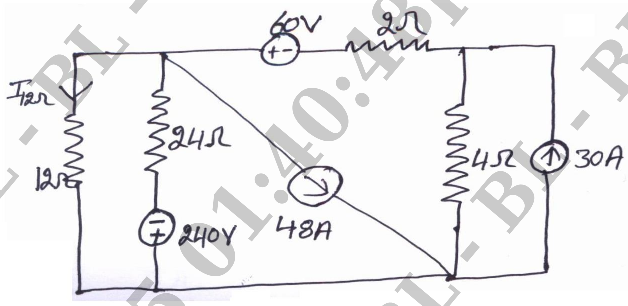
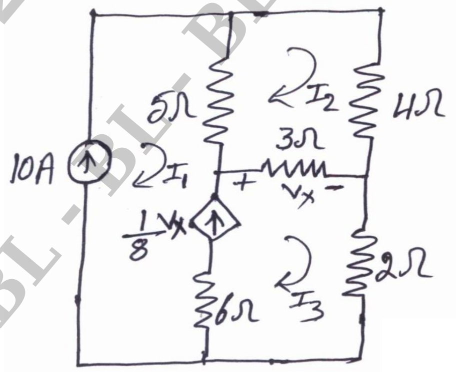
BEC304

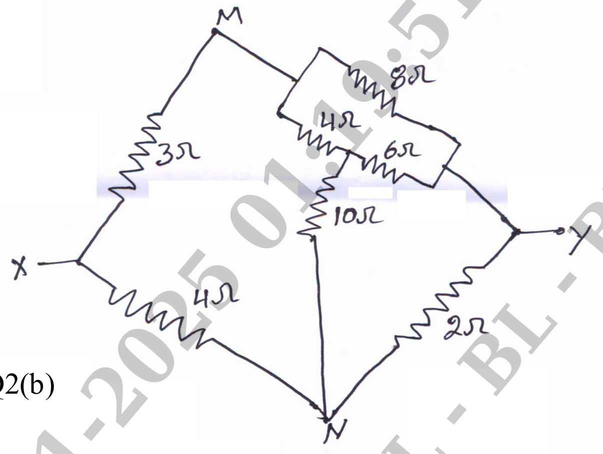
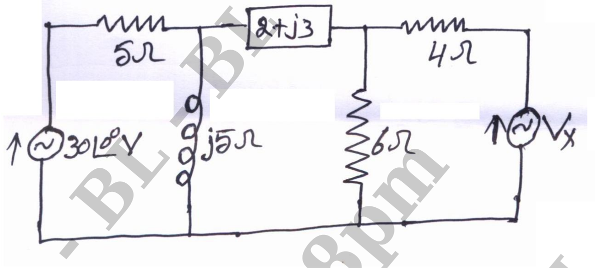
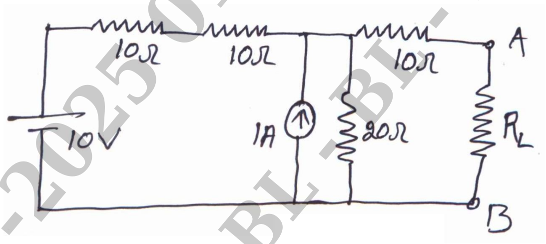
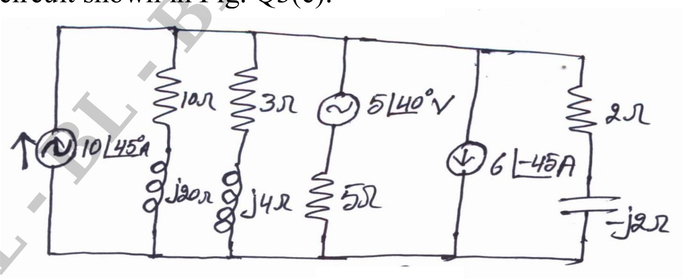
Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

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.**	Three impedances are connected in Delta. Obtain the star equivalent of the network.	**7**	**L3**	**CO1**
	b.	For the circuit shown in Fig. Q1(b). Find the voltage 'V' at node by using nodal analysis. Fig. Q1(b) 	**6**	**L3**	**CO1**
	c.	Determine the current in 12Ω resistor shown in Fig. Q1(c) using source transformation method. Fig. Q1(c) 	**7**	**L3**	**CO1**
		OR			
Q.2	**a.**	Find the loop currents I_1, I_2, and I_3 in the circuit shown in Fig. Q2(a). Fig. Q2(a) 	**7**	**L3**	**CO1**

	b.	Determine the resistance between the terminals X, Y using star delta transformation in the network shown in Fig. Q2(b).  Fig. Q2(b)	6	L3	CO1
	c.	Use the nodal analysis to find the value of V_X and the circuit shown in Fig. Q2(c). Such that the current through (2 + j3) Ω Impedance is zero.  Fig. Q2(c)	7	L3	CO1
Module – 2					
Q.3	a.	Sate and prove Superposition theorem.	7	L2	CO2
	b.	For the circuit shown in Fig. Q3(b), obtain the Thevenin's equivalent circuit.  Fig. Q3(b)	7	L3	CO2
	c.	Using Millman's theorem, find current flowing through (3 + j4) Ω impedance for the circuit shown in Fig. Q3(c).  Fig. Q3(c)	6	L3	CO2
OR					

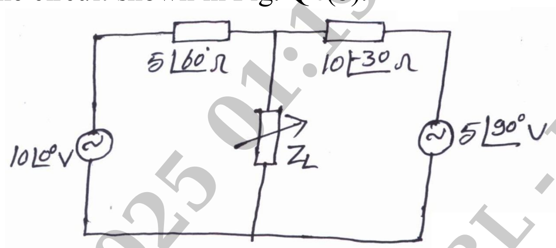
<table>
<tr><td>Q.4</td><td>a.</td><td>State and prove Norton's theorem.</td><td>7</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Find the value of Z_L for Maximum Power transfer and the value of Maximum power for the circuit shown in Fig. Q4(b).
 

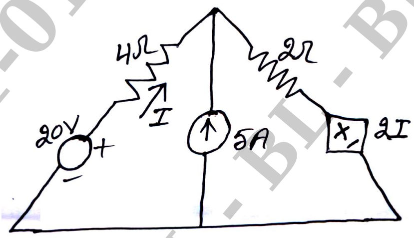
Fig. Q4(b)</td><td>6</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>Find current 'I' using Super position theorem for the circuit shown in Fig. Q4(c).
 

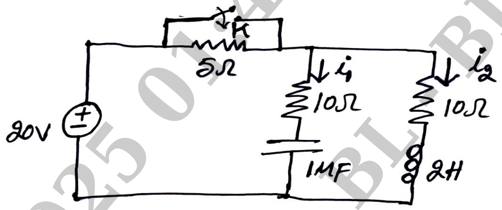
Fig. Q4(c)</td><td>7</td><td>L3</td><td>CO2</td></tr>
<tr><td colspan="6">Module – 3</td></tr>
<tr><td>Q.5</td><td>a.</td><td>Use the concepts of initial condition to illustrate the voltage behavior in inductor circuit for DC supply.</td><td>6</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>In the circuit steady state is reached with switch 'K' open. The switch is closed at t = 0. Compute i , di/dt and d^2i/dt^2 at $t = 0^+$.
 

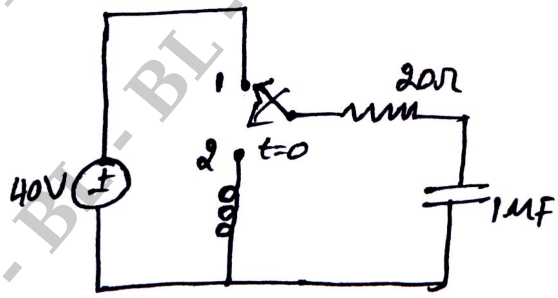
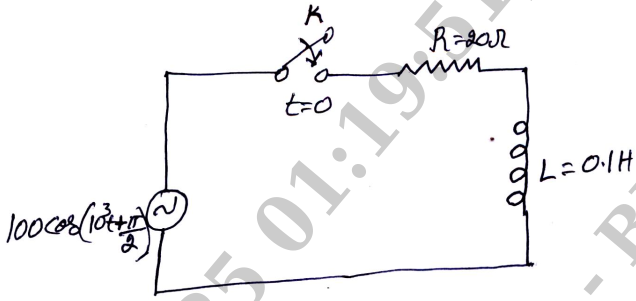
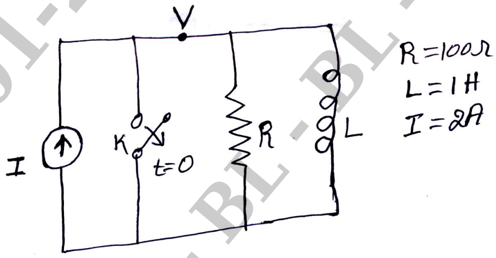
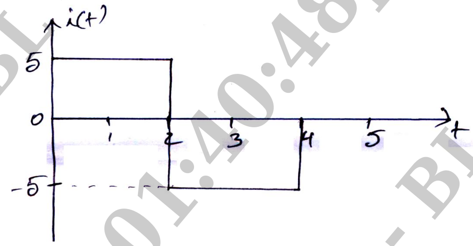
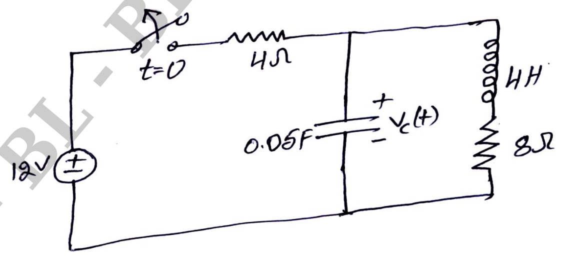
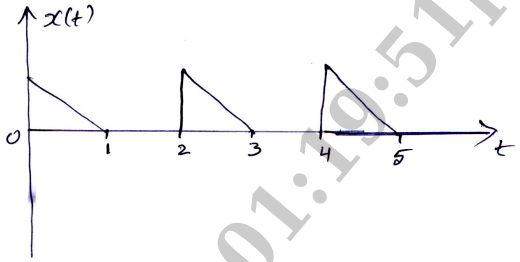
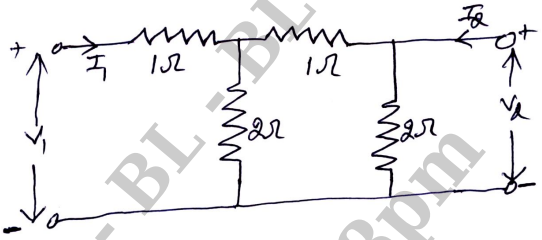
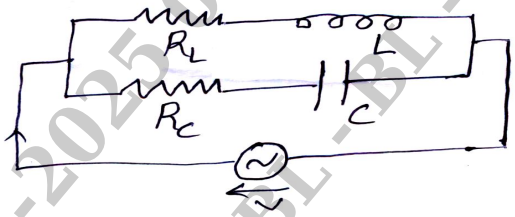
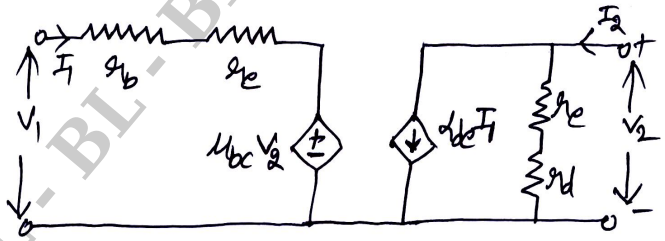
Fig. Q5(b)</td><td>7</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>The switch is moved from position (1) to position (2) at t = 0. The steady state has been reached before switching. Computer i , di/dt and d^2i/dt^2 at $t = 0^+$ for Fig. Q5(c).
 

Fig. Q5(c)</td><td>7</td><td>L4</td><td>CO3</td></tr>
<tr><td colspan="6">OR</td></tr>
</table>

Q.6	**a.**	In the circuit shown in Fig. Q6(a), determine complete solution for current when switch 'K' is closed at t = 0. Fig. Q6(a) 	**10**	**L3**	**CO3**
	b.	Compute v , dv/dt , d^2v/dt^2 at $t = 0^+$ for the circuit shown in below Fig. Q6(b), when the switch K is opened at t = 0. Fig. Q6(b) 	**10**	**L4**	**CO3**
		Module – 4			
Q.7	**a.**	Using waveform synthesis method to express the voltage pulse interms of unit step. Find i) L{i(t)} ii) L{∫ i(t).dt}. Fig. Q7(a) 	**8**	**L3**	**CO4**
	b.	State and prove initial value and final value theorem for Laplace transform.	**6**	**L2**	**CO4**
	c.	Obtain the Laplace transform of step and ramp function with relevant expressions.	**6**	**L3**	**CO4**
		OR			
Q.8	**a.**	Determine $i_L(t)$ for $t \geq 0$ using Laplace transform for circuit shown in Fig. Q8(a). Fig. Q8(a) 	**10**	**L3**	**CO4**

	b.	Find the Laplace transform of the periodic signal x(t) as shown in Fig. Q8(b).  Fig. Q8(b)	**10**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Define Z – parameters. Determine Y parameters interms if Z – parameters.	**6**	**L3**	**CO5**
	b.	Show that resonant frequency is geometric mean of cut off frequency in series R – L – C circuit.	**7**	**L3**	**CO5**
	c.	Apply the two – port network analysis technique to determine ABCD – parameters of the network shown in Fig. Q9(c).  Fig. Q9(c)	**7**	**L3**	**CO5**
		OR			
Q.10	**a.**	Derive the expression for the resonant frequency of the circuit shown in Fig. Q10(a). Also show that the circuit resonate at all frequency if $R_L = R_C = \sqrt{\frac{L}{C}}$.  Fig. Q10(a)	**10**	**L3**	**CO5**
	b.	The model of a transistor in the CE mode is shown in Fig. Q10(b). Determine the h – parameters.  Fig. Q10(b)	**10**	**L3**	**CO5**

* * * * *

CBCS SCHEME

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

BEC358B

Third Semester B.E./B.Tech Degree Examination, June/July 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
1	a.	List and explain the three basic windows in MATLAB.	6	L1	CO1
	b.	Mention the output of the commands exp(Pi/2∗i) and exp(Pi/2i), if they are executed is MATLAB. Also explain the difference between the two results.	4	L3	CO1
		OR			
2	a.	Explain briefly about the different screen output formats in MATLAB with suitable examples.	6	L	CO
	b.	Write the MATLAB commands to execute the following statements and compute the results : i) Create a vector t with 10 elements : 1, 2, 3, ...10 ii) $x = t \sin(t)$ iii) $y = \frac{t-1}{t+1}$ iv) $z = \frac{\sin(t^2)}{t^2}$.	4	L	CO
		Module – 2			
3	a.	Explain briefly about the following MATLAB commands with appropriate examples : i) Plot ii) Figure iii) Grid iv) Subplot.	6	L2	CO2
	b.	Write a function file to draw a circle of specified radius, with the radius as the input to the function. Use parametric equation of the circle to generate 100 equidistant points of x and y coordinates for plotting the circle.	4	L3	CO2
		OR			
4	a.	Write the MATLAB commands along with solutions of the command to carry out the following instructions : $\begin{bmatrix} 4 & 2 & 2 \\ 4 & 5 & 6 \\ 1 & 2 & 9 \end{bmatrix}$ i) Use appropriate command and generate the above matrix and assign to variable A ii) To create transpose of the first row of A and assign to X iii) Compute B as product of row vector X^1 and column vector X iv) Compute C as product of column vector X and row vector X^1 v) Compute A ∗ A and square of A and comment vi) Extract the submatrix form A using the range specifies for row and column indices (2nd row to 3rd and 1st column to 3rd column).	7	L3	CO2
	b.	Discuss briefly about the following functions with example used in MATLAB program : i) zero( ) ii) ones( ) iii) eye( ).	3	L2	CO2

Module – 3					
5	**a.**	Illustrate with examples the three different kinds of files for reading data in MATLAB's workspace.	**5**	**L2**	**CO3**
	b.	Create three anonymous functions corresponding to the following expressions : $f(x) = x^4 - 8x^3 + 17x^2 - 4x - 20$ $g(x) = x^2 - 4x + 4$ $h(x) = x^2 - 4x - 5$ i) Create anonymous function to evaluate : $f(x) - g(x)h(x)$ at $x = 3$ ii) Create anonymous function to evaluate : $f(x) - g(x)h(x)$ at $x = [1\ 2\ 3\ 4\ 5]$.	**5**	**L3**	**CO3**
OR					
6	**a.**	Solve the following set of simultaneous linear algebraic equations using appropriate MATLAB symbolic computations : $x + 3y - z = 2$ $x - y + z = 3$ $3x - 5y = 4$.	**5**	**L3**	**CO3**
	b.	Explain briefly about the following MATLAB commands : i) pwd ii) dir iii) IS iv) cd v) make dir or mk dir.	**5**	**L1**	**CO3**
Module – 4					
7	**a.**	Demonstrate briefly about reshaping matrices using MATLAB commands with suitable examples.	**4**	**L2**	**CO4**
	b.	Compute the following MATLAB commands : i) fix([–2.33 2.66]) ii) floor([–2.33 2.66]) iii) ceil([–2.33 2.66]) iv) round([–2.33 2.66]) v) mod(26, 5) vi) sign([–2.33 2.66]).	**6**	**L3**	**CO4**
OR					
8	**a.**	Apply the six relational operators in MATLAB to the operands x = [1 5 3 7] and y = [0 2 8 7]. Comment on the results obtained.	**6**	**L3**	**CO4**
	b.	What are command – line functions? Explain with examples.	**4**	**L1**	**CO4**
Module – 5					
9		Explain briefly about script file and function file with suitable examples.	**10**	**L**	**CO**
OR					
10	**a.**	Write a MATLAB function file to solve the set of linear system equations using the Cramer's method : $x + y + z = 1$ $2x - 6y - z = 0$ $3x + 4y + 2z = 0$.	**7**	**L3**	**CO4**
	b.	Illustrate the Recursion function is MATLAB with appropriate examples.	**3**	**L2**	**CO4**

* * * * *

CBCS SCHEME

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

BMATEC301/BEC301/BBM301

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
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. Statistical table and Mathematics formula handbook are allowed.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		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 $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+.....=\frac{\pi}{4}$.	6	L2	CO1
	b.	Find the Fourier series of $f(x)=\lvert x\rvert$ in $(-\ell, \ell)$. Hence show that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+......=\frac{\pi^2}{8}$.	7	L3	CO1
	c.	Expand f(x) = 2x – 1 as a cosine half range Fourier series in $0<x<1$.	7	L2	CO1
		OR			
Q.2	**a.**	Find the Fourier series of $f(x)=\begin{cases}1+\frac{2x}{\pi} & \text{in } -\pi<x<0 \\ 1-\frac{2x}{\pi} & \text{in } 0<x<\pi\end{cases}$. Hence deduce that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+.......$	6	L2	CO1
	b.	Obtain the sine half range series of, $f(x)=\begin{cases}\frac{1}{4}-x & \text{in } 0<x<\frac{1}{2} \\ x-\frac{3}{4} & \text{in } \frac{1}{2}<x<1\end{cases}$	7	L2	CO1
	c.	Determine the constant term and the first cosine and sine terms of the Fourier series expansion of y from the following data :	7	L1	CO1

x° :	0	45	90	135	180	225	270	315
y:	2	$\frac{3}{2}$	1	$\frac{1}{2}$	0	$\frac{1}{2}$	1	$\frac{3}{2}$

		Module – 2	**M**	**L**	**C**
Q.3	**a.**	Find the Fourier transform of the function, $f(x)=\begin{cases}1 & \text{for } \lvert x\rvert\le a \\ 0 & \text{for } \lvert x\rvert>a\end{cases}$. Hence evaluate $\int_0^\infty \frac{\sin x}{x}dx$.	6	L2	CO2
	b.	Find the Fourier sine and cosine transforms of $f(x)=e^{-\alpha x}$, $\alpha>0$.	7	L2	CO2
	c.	Find the Fourier sine transform of $\frac{e^{-ax}}{x}$, $a>0$.	7	L3	CO2

		OR			
Q.4	**a.**	If $f(x)=\begin{cases}1-x^2, & \lvert x\rvert<1\\ 0, & \lvert x\rvert\geq 1\end{cases}$, find the Fourier transform of f(x) and hence find the value of, $\int_0^{\infty}\frac{x\cos x-\sin x}{x^3}dx$.	**6**	**L2**	**CO2**
	b.	Find the Fourier sine transform of $f(x)=e^{-\lvert x\rvert}$ and hence evaluate $\int_0^{\infty}\frac{x\sin mx}{1+x^2}dx,\ m>0.$	**7**	**L3**	**CO2**
	c.	Find the Discrete fast fourier of signal = $(0, 1, 49)^T$	**7**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Find the z-transform of, (i) $\cosh n\theta$ (ii) $\sinh n\theta$	**6**	**L1**	**CO3**
	b.	If $V(z)=\frac{2z^2+3z+12}{(z-1)^4}$, evaluate u_0, u_1 and u_2	**7**	**L2**	**CO3**
	c.	Find the inverse z-transform of, $\frac{z}{(z-1)(z-2)}$.	**7**	**L2**	**CO3**
		OR			
Q.6	**a.**	Solve by using z-transforms, $y_{n+2}+2y_{n+1}+y_n=n$ with $y_0=0=y_1$	**6**	**L3**	**CO3**
	b.	Find $z_T^{-1}\left[\frac{5z}{(3z-1)(2-z)}\right]$.	**7**	**L2**	**CO3**
	c.	Solve by using z-transforms $u_{n+2}-5u_{n+1}+6u_n=2^n$ with $u_0=0=u_1$.	**7**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Solve $\frac{d^3y}{dx^3}+6\frac{d^2y}{dx^2}+11\frac{dy}{dx}+6y=0$.	**6**	**L1**	**CO4**
	b.	Solve $(D^2+1)y=x^2+4x-6$.	**7**	**L2**	**CO4**
	c.	Using the method of variation of Parameters of $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+9y=e^{3x}$	**7**	**L3**	**CO4**
		OR			
Q.8	**a.**	Solve $6\frac{d^2y}{dx^2}+17\frac{dy}{dx}+12y=e^{-x}$.	**6**	**L2**	**CO4**
	b.	Solve the Cauchy's differential equation, $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+8y=65\cos(\log x)$.	**7**	**L2**	**CO4**
	c.	The charge q in a series circuit containing an Inductance L, Capacitance C, emf E satisfy the differential equation, $L\frac{d^2q}{dt^2}+\frac{q}{C}=E$. Express q in terms of t.	**7**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Fit a second degree parabola $y=a+bx+cx^2$ into least square sense for the data and estimate y at x = 6. x: 1, 2, 3, 4, 5 y: 10, 12, 13, 16, 19	**6**	**L1**	**CO5**

	b.	Find a correlation coefficient for the two variables x and y. x: 92 89 87 86 83 77 71 63 53 50 y: 86 83 91 77 68 85 52 82 37 57	**7**	**L2**	**CO5**
	c.	Ten students got the following percentage of marks in two subjects x and y. Compute the rank correlation coefficient. x: 78 36 98 25 75 82 90 62 65 39 y: 84 51 91 60 68 62 86 58 53 47	**7**	**L2**	**CO5**
		OR			
Q.10	**a.**	If θ is the angle between the lines of regression show that $\tan\theta = \frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2}\left(\frac{1-r^2}{r}\right)$.	**6**	**L2**	**CO5**
	b.	Obtain the lines of regression and hence find the coefficient of correlation for the data, x: 1 3 4 2 5 8 9 10 13 15 y: 8 6 10 8 12 16 16 10 32 32	**7**	**L2**	**CO5**
	c.	If $8x - 10y + 66 = 0$ and $40x - 18y = 214$ are the two regression lines. Find $\bar{x}$, $\bar{y}$ and r. Find σ_y if $\sigma_x = 3$.	**7**	**L2**	**CO5**

* * * * *

CBCS SCHEME

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

Fourth Semester B.E. Degree Examination, Dec.2024/Jan.2025
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. Derive the expression for Emitter current of a voltage divider bias and also discuss how to make I_E insensitive to variation in β and temperature. **(10 Marks)**

b. Design a collector to Base feedback resistor bias to obtain a dc current of 1 mA and to ensure $\pm 2V$ signal swing at the collector with $V_{CE} = 2.3V$. Assume $V_{CC} = 10$ V and $\beta = 100$. **(07 Marks)**

c What is trans-conductance of BJT and mention its significance? **(03 Marks)**

OR

2 a. Obtain the following expression of a BJT of small signal analysis.
i) Total instantaneous collector current
ii) Input resistance at the base **(10 Marks)**

b. Discus the following biasing scheme used in MOS
i) By fixing V_{GS}
ii) By fixing V_{GS} and connecting a resistance in the source. **(10 Marks)**

Module-2

3 a. Discuss the basic configuration of MOSFET. **(06 Marks)**

b. For a common source amplifier shown in Fig Q3(b), determine R_{in}, AV_0, R_0 and G_V

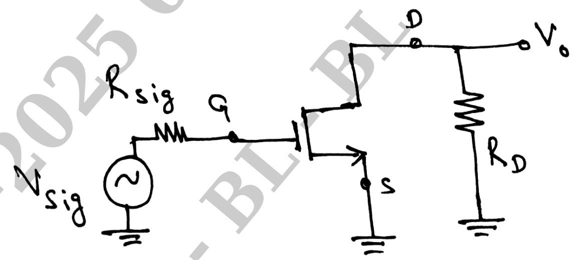


Fig Q3(b) **(14 Marks)**

OR

4 a. For an n-channel MOSFET with t_{ox} = 10nm, L = 1.0 μm, W = 10 μm, L_{OV} = 0.05 μm, $C_{sbo} = C_{dbo}$ = 10 fF, V_0 = 0.6 V, V_{SB} = 1 V and V_{DS} = 2 V. Calculate C_{ox}, C_{ov}, C_{gs}, C_{gd}, C_{sb} and C_{db}. **(10 Marks)**

b. Explain the working of FET based phase shift oscillator and also mention the necessary conditions for sustained oscillation. **(10 Marks)**

Module-3

5 a. Explain the following properties of Negative. Feedback.
i) Gain, De-sensitivity ii) Bandwidth Extension iii) Noise reduction **(14 Marks)**

b. A negative feedback amplifier has a $A_f = 100$ and $A = 10^5$. What is the feedback factor? If a manufacturing error results in a reduction of A to 10^3, what is the closed loop voltage Gain? What is the percentage change in A_f? **(06 Marks)**

OR

6 a. Explain the working of class B output stage. **(08 Marks)**

b. For emitter follower Class A output stage $V_{cc} = 10V$, $I = 100$ mA and $R_L = 100\ \Omega$. If the output voltage is an 8 V – peak sinusoid, find :
i) Power delivered to load
ii) Average power drawn from the supplies
iii) Power conversion efficiency ignore the loss on Q_3 and R. **(06 Marks)**

c. Explain how cross over distortion can be eliminated to class AB output stage. **(06 Marks)**

Module-4

7 a. For the voltage Seri feedback amplifier, derive the expressions of
i) Exact voltage Gain ii) Input resistance with feedback iii) Output resistance with feedback **(14 Marks)**

b. For the inverting amplifier $R_1 = 470\ \Omega$ and $R_F = 4.7\ K\Omega$. Assume A = 200000, $R_i = 2\ M\Omega$, $R_o = 75\ \Omega$ and $f_o = 5$ Hz. Calculate A_F, R_{iF}, R_{OF} and f_F. **(06 Marks)**

OR

8 a. Explain the working of instrumentation amplifier using Transducer bridge with necessary equations. **(08 Marks)**

b. Explain the working of Inverting Schmitt trigger with input and output waveforms. **(08 Marks)**

c. For a Differential configuration summer R = 1 KΩ, $V_a = 2V$, $V_b = 3V$, $V_c = 4V$, $V_d = 5V$ and supply voltage of ± 15V. Determine the output voltage V_o. **(04 Marks)**

Module-5

9 a. Derive the expression of output voltage of a 4-bit Binary weighted resistor type DAC. Mention its disadvantages. **(10 Marks)**

b. Draw the block diagram of successive approximation ADC and explain it. **(10 Marks)**

OR

10 a. Explain the working of First order active Lowpass filter with the help of magnitude voltage gain and also design to get a cutoff frequency of 1 KHz with a passband gain of 2. **(10 Marks)**

b. Explain the working of Astable multi-vibration using 555 Timer and also derive the expression of Frequency of oscillation. **(10 Marks)**

* * * * *

USN | | | | | | | | | |

18EC43

Fourth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Control Systems

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of semilog graph sheets are permitted.

Module-1

1 a. Define control system. Distinguish between open loop and closed loop systems with examples. **(07 Marks)**

b. For the mechanical system shown in Fig. Q1 (b),
   (i) Draw mechanical network.
   (ii) Write difference equations of performance.
   (iii) Draw electrical network based on force voltage analogy. **(08 Marks)**

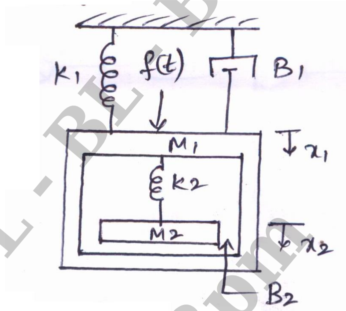


Fig. Q1 (b)

c. Discuss the effect of feedback on,
   (i) Overall gain (ii) Stability **(05 Marks)**

OR

2 a. For the electromechanical system shown in Fig. Q2 (a), determine the transfer function $\frac{X(s)}{E(s)}$. **(10 Marks)**

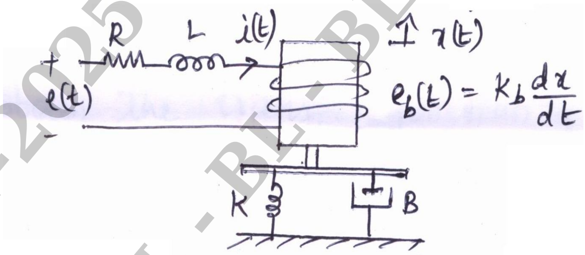


Fig. Q2 (a)

b. For the mechanical system shown in Fig. Q2 (b),
   (i) Draw the mechanical network
   (ii) Draw electrical network based on torque-current analogy
   (iii) Write performance equations. **(10 Marks)**

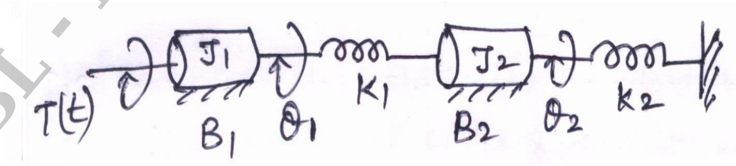


Fig. Q2 (b)

Module-2

3 a. Write Mason's gain formula for signal flow graph. Indicate what each term represents. **(05 Marks)**

b. Reduce the block diagram shown in Fig. Q3 (b), using block diagram reduction rules and obtain $\frac{C(s)}{R(s)}$. **(08 Marks)**

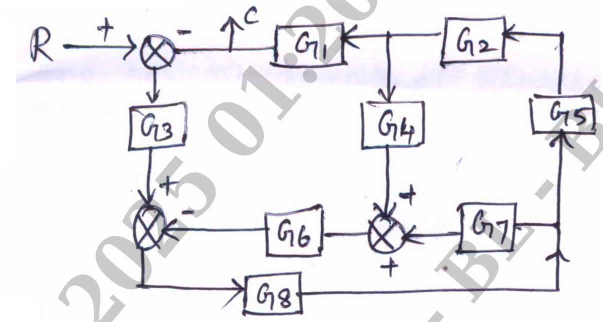


Fig.Q3 (b)

c. Find the transfer function for the following network shown in Fig.Q3 (c) using Mason's gain formula.

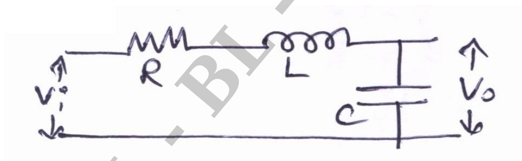


Fig.Q3 (c) **(07 Marks)**

OR

4 a. Obtain the transfer function of the system shown in Fig. Q4 (a) using Mason's gain formula. **(12 Marks)**

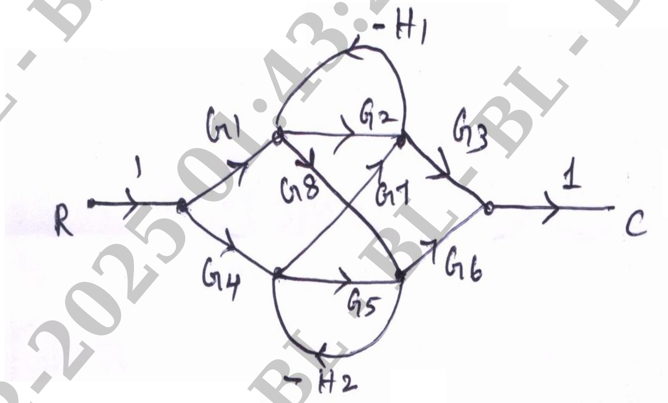


Fig. Q4 (a)

b. Determine the overall transfer function for the block diagram shown in Fig. Q4 (b). **(08 Marks)**

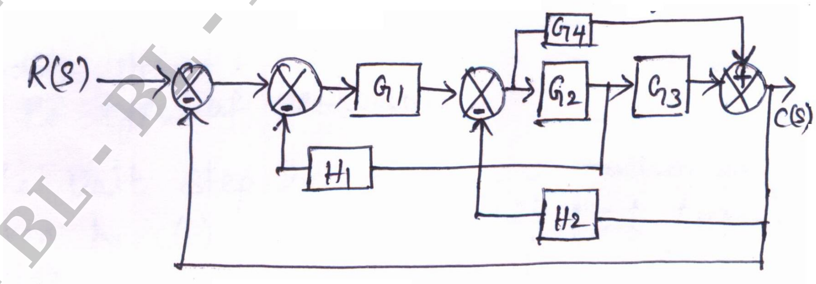


Fig. Q4 (b)

Module-3

5 a. With the help of graphical representation and mathematical expression, explain the following test signals : (i) Step signal (ii) Ramp signal (iii) Parabolic signal (iv) Impulse signal. **(08 Marks)**

b. For a unity negative feedback control system with $G(s) = \frac{50}{s(s+5)}$, find the following :

(i) Percentage overshoot for unit step input.
(ii) Settling time for a unit step input.
(iii) Steady state error for an input defined by polynomial $r(t) = 2 + 4t + 6t^2$; $t \geq 0$. **(08 Marks)**

c. Define rise time and maximum overshoot and also write their formula for II order systems. **(04 Marks)**

OR

6 a. For a unity feedback control systems, the open loop transfer function $G(s) = \frac{10(s+2)}{s^2(s+1)}$ find,

(i) The position, velocity and acceleration error constants.
(ii) The steady state error when input is R(s) where $R(s) = \frac{3}{s} - \frac{2}{s^2} + \frac{1}{3s^3}$ **(08 Marks)**

b. With the help of general block diagrams, explain the following :
(i) PD type of controller.
(ii) PI type of controller. **(08 Marks)**

c. The unit step response of a system is given by $C(t) = \frac{5}{2} + 5t - \frac{5}{2}e^{-2t}$. Find transfer function and identify order of system. **(04 Marks)**

Module-4

7 a. The open loop transfer function of unity feedback system is given by, $G(s) = \frac{K(s+1)}{s^3 + as^2 + 2s + 1}$. Determine the value of K and a so that system oscillates at frequency of 2 rad/sec. **(08 Marks)**

b. State and explain Routh's stability criterion for determining the stability of the system and mention its limitations. **(06 Marks)**

c. Sketch the root locus plot for a negative feedback control system having an open loop transfer function,

$G(s)H(s) = \frac{K}{s(s+1)(s+2)}$. **(06 Marks)**

OR

8 a. The open loop transfer function of a system is $G(s) = \frac{K}{s(1+s)(1+0.1s)}$. Determine the values of K such that,
(i) Gain margin = 10 dB
(ii) Phase margin = 24°.
Use Bode plot. **(12 Marks)**

b. Define the following terms in connection with bode plots :
(i) Gain cross over frequency
(ii) Phase cross over frequency
(iii) Gain margin
(iv) Phase margin **(08 Marks)**

Module-5

9 a. Sketch the polar plot for open loop transfer function, $G(s)H(s) = \frac{10}{(s+2)(s+4)}$. Determine gain cross over frequency, phase cross over frequency, gain margin, phase margin. Also comment on stability. **(10 Marks)**

b. Explain Nyquist stability criterion and also list the advantages of Nyquist plot. **(05 Marks)**

c. Write a short note on lead compensator. **(05 Marks)**

OR

10 a. List the properties of state transistion matrix. **(05 Marks)**

b. Obtain state transition matrix $\phi(t)$ 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 obtain the inverse of state transition matrix $\phi^{-1}(t)$. **(10 Marks)**

c. Define : (i) State variables
(ii) State vector
(iii) State space **(05 Marks)**

* * * * *

CBCS SCHEME

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

18EC44

Fourth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Engineering Statistics and Linear Algebra

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define CDF of a Random variable. Mention its properties and types. **(10 Marks)**

b. Given the data in the Table Q1(b)
i) Plot the PDF and CDF of the discrete random variable
ii) Write expressions for $f_X(x)$ and $F_X(x)$ using unit delta functions and unit step functions :

x	x_a	x_b	x_c	Total
P[X = x]	0.24	0.32	0.44	1

Table Q1(b) **(10 Marks)**

OR

2 a. Summarize the properties of PDF. Prove that the total area under PDF curve is unity. **(10 Marks)**

b. Given the data in the Table Q2(b).
i) What are the mean and variance of 'X' ii) If $Y = X^2 + 2$, what are μ_y and σ_y^2.

K	1	2	3	4	5
X_k	2.1	3.2	4.8	5.4	6.9
$P(x_k)$	0.21	0.18	0.2	0.22	0.19

Table Q2(b) **(10 Marks)**

Module-2

3 a. Explain the following with respect to Bivariate Random variable.
i) Correlation ii) Covariance iii) Uncorrelated X and Y iv) Orthogonal X and Y
v) Independent X and Y. **(10 Marks)**

b. Let X is a random variable, $\mu_x = 4$ and $\sigma_x = 5$ and Y is a random variable, $\mu_y = 6$ and $\sigma_y = 7$. The correlation coefficient is -0.7. If $U = 3x + 2y$, what are i) Var [U] ii) CoV [UX] iii) CoV [UY]. **(10 Marks)**

OR

4 a. Briefly explain the following random variables
i) Chi-square RV ii) Student-T RV iii) Cauchy RV iv) Rayleigh RV. **(10 Marks)**

b. The joint PDF $f_{XY}(x, y) = C$, a constant when $(0 < x < 3)$ and $(0 < y < 3)$ and is '0' otherwise.
i) What is the value of constant C
ii) What is the PDF's for X and Y
iii) What is $F_{XY}(x, y)$ when $(0 < x < 3)$ and $(0 < y < 3)$
iv) What are $F_{XY}(x, \infty)$ and $F_{XY}(\infty, y)$
v) Are X and Y independent? **(10 Marks)**

Module-3

5 a. Interpret the following with respect to random process i) Random process ii) Ensemble iii) PDF iv) Independence v) Expectations vi) Stationary. **(12 Marks)**

b. The magnitude of a zero mean white noise spectrum is $K = 3.6 \times 10^{-8}\ V^2\text{-S}$. This noise is the input to a low pass RC circuit: $R = 38\ k\Omega$, $C = 0.1\ \mu F$. Find the networks output PSD, $S_y(w)$. **(08 Marks)**

OR

6 a. Discuss the Auto correlation and cross correlation functions with their properties. **(12 Marks)**

b. A Random process is described by $y(t) = A\cos(w_c t + \theta)$ where A and w_c are constants, but θ is a random variable distributed uniformly between $\pm\pi$. Determine :

i) PDF of random variable 'θ'
ii) Mean of y(t)
iii) Auto correlation function $R_y(\tau)$
iv) Mean power and Auto variance of y(t) **(08 Marks)**

Module-4

7 a. Illustrate vector space with its properties in detail. **(08 Marks)**

b. Apply Gram-Schmidt process to

$$a = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \quad b = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix} \text{ and } c = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

Write the result in the form of A = QR. **(12 Marks)**

OR

8 a. Outline the four fundamental suspaces of matrices. **(08 Marks)**

b. Determine : i) matrix U and Rank ii) rref (R) iii) Null space of matrix and identify free variables in null space for the matrix given $A = \begin{bmatrix} 1 & 3 & 3 & 2 \\ 2 & 6 & 9 & 7 \\ -1 & -3 & 3 & 4 \end{bmatrix}$ **(12 Marks)**

Module-5

9 a. Define determinants with its properties in detail. **(13 Marks)**

b. Determine the Eigen values of matrix $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ **(07 Marks)**

OR

10 a. Diagnolize the matrix $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ and hence find A^4, Also find the matrix 'P' such that $P^{-1}AP$ is diagonal. **(14 Marks)**

b. Reduce the matrix A to U and find det A using pivots of A.

$$A = \begin{bmatrix} 2 & 5 & 3 \\ 1 & 2 & 4 \\ -1 & 3 & 6 \end{bmatrix}$$ **(06 Marks)**

* * * * *

CBCS SCHEME

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

18EC45

Fourth Semester B.E. Degree Examination, June/July 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. Sketch the even and odd parts of the signal shown in Fig Q1(a)-i), ii).

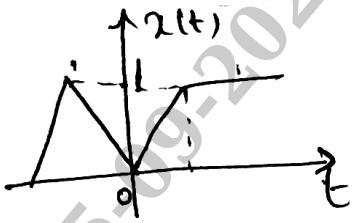


Fig Q1(a)-i)

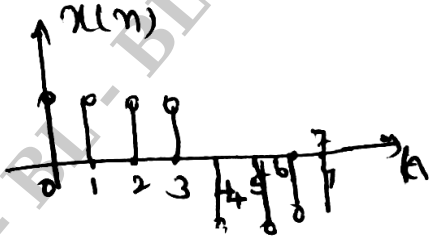


Fig Q1(a)- ii) **(08 Marks)**

b. Find the even components and odd components of the following equation
i) $x(t) = 1 + \cos t + t^2 \sin t + t^3 \sin t \cos t$ ii) $x(n) = \{-3, \underset{\uparrow}{1}, 2, -4, 2\}$ **(06 Marks)**

c. Determine whether the following signal is periodic or not if periodic find the fundamental period. i) $x(n) = \cos\frac{n\pi}{5}\sin\frac{n\pi}{3}$ ii) $x(t) = (\cos(2\pi t))^2$. **(06 Marks)**

OR

2 a. Explain with an example i) even and odd signal ii) energy and power signal iii) Time shifting iv) Time scaling v) Precedence rule. **(10 Marks)**

b. A continuous time signal x(t) is shown in Fig Q2(b) plot the following signal
i) $x\left(\frac{t}{2}+1\right)$ ii) $x[-2(t+1)]$ iii) $x(-2t-1)$.

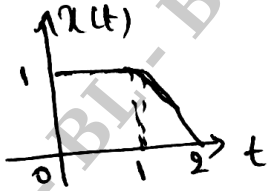


Fig Q2(b) **(06 Marks)**

c. If x(n) is as shown is Fig Q2(c) find the energy of the signal x(2n – 1)

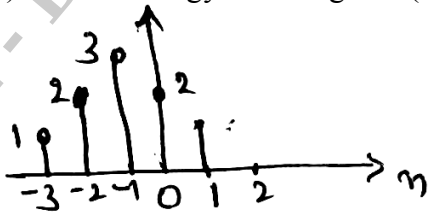


Fig Q2(c) **(04 Marks)**

Module-2

3 a. For the signal x(t) and y(t) shown in Fig Q3(a). Sketch the following signals
i) $x(t+1)\,y(t-2)$ ii) $x(t)\cdot y(t-1)$

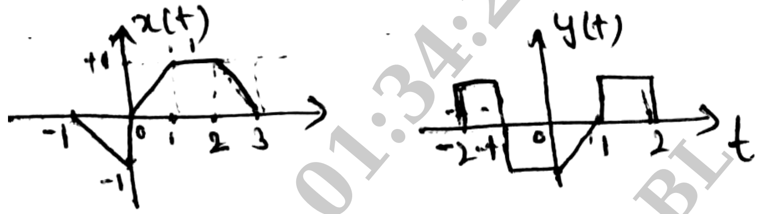


Fig Q3(a) **(10 Marks)**

b. Determine whether the following systems are memory less, causal, time invariant, stable
i) $y(n) = nx(n)$ ii) $y(t) = x(t/2)$ **(10 Marks)**

OR

4 a. Prove the following :

i) $x(n)*[h_1(n)*h_2(n)] = [x(n)*h_1(n)*x(n)*h_2(n)]$ ii) $x(n)*u(n) = \sum_{k=-\infty}^{\infty} x(k)$ **(08 Marks)**

b. The impulse response of the discrete LTI system is given by, $h(n) = u(n+1) - u(n-4)$. The system is excited by the input signal $x(n) = u(n) - 2u(n-2) + u(n-4)$. Obtain the response of the system $y(n) = x(n) * h(n)$ and plot the same. **(08 Marks)**

c. A system consists of several subsystems connected as shown in Fig Q4(c). Find the operator H relating x(t) to y(t) for the following sub systems operators.

$H_1 = y_1(t) = x_1(t)\,x_1(t-1)$
$H_2 : y_2(t) = |x_2(t)|$
$H_3 : y_3(t) = 1 + 2x_3(t)$
$H_4 : y_4(t) = \cos(x_4(t))$

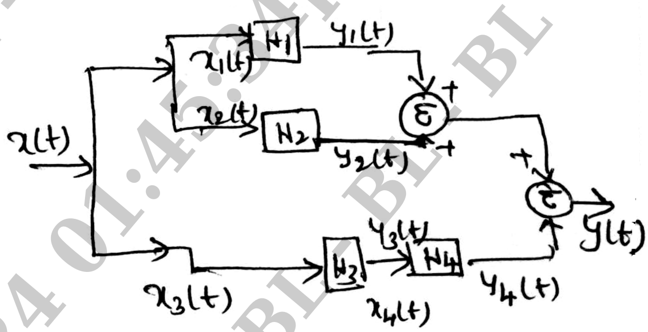


Fig Q4(c)

(04 Marks)

Module-3

5 a. Check whether the following systems are stable and causal
i) $h(t) = e^{-2t}u(t-1)$ ii) $h(t) = e^{-4t}u(t-10)$ iii) $h(t) = te^{-t}u(t)$ **(09 Marks)**

b. Find the step response of a LTI system if impulse response $h(t) = t^2\,u(t)$. **(04 Marks)**

c. Find the complex Fourier coefficient for $x(t) = \cos\left(\frac{2\pi}{3}t\right) + 2\cos\left(\frac{5\pi}{3}t\right)$. **(07 Marks)**

OR

6 a. Determine the output y(t) of a LTI system with impulse response

$h(t) = u(t+1) - 2u(t) + u(t-1)$ and input $x(t) = \begin{cases} 1 \text{ for } & |t| \le 2 \\ 0 \text{ for } & |t| > 2 \end{cases}$

Sketch the signals h(t), x(t) and y(t). **(12 Marks)**

b. Determine the FS representation for the signal x(t) of fundamental period T given by $x(t) = 3\cos\left[\frac{\pi}{2}t + \frac{\pi}{4}\right]$. Sketch the magnitude and phase of x(k). **(08 Marks)**

Module-4

7 a. State and prove the following properties

i) $y(t) = h(t)*x(t) \xleftrightarrow{FT} y(j\omega) = x(j\omega)H(j\omega)$

ii) $\frac{d}{dt}x(t) \xleftrightarrow{FT} j\omega X(\omega)$

iii) $y(t) = x(t - t_0) \xleftrightarrow{FT} y(\omega) = e^{-j\omega t_0} X(\omega)$ **(10 Marks)**

b. Find DTFT of the following signals

i) $x(n) = \{1, 2, \underset{\uparrow}{3}, 2, 1$ ii) $x(n) = (3/4)^n u(n)$ **(10 Marks)**

OR

8 a. Determine the Fourier transform of unit step sequence x(n) = u(n). **(04 Marks)**

b. A discrete signal is defined by $x(n) = \sin\left(\frac{\pi n}{8}\right)$ sketch the magnitude and phase of DTFT of x(n – 2). **(08 Marks)**

c. Define Nyquist rate (aliasing), and specific the Nyuist rate and Nyquist intervals for the following signals :

i) $g_1(t) = \text{sinc}\,(200t)$ ii) $g_2(t) = \text{sinc}^2(200t)$ iii) $g_3(t) = \text{sinc}\,200t + \text{sinc}^2\,(200t)$ **(08 Marks)**

Module-5

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

b. Using the properties of a transform, find the z-transform of these signals.

i) $x_1(n) = n(5/8)^n u(n)$ ii) $x_2(n) = (0.9)^n u(n) * (0.6)^n u(n)$ iii) $x_3(n) = (2/3)^n u(n + 2)$. **(06 Marks)**

c. Determine the Z-transform of the following signals

i) $x(n) = \left(\frac{1}{4}\right)^n u(n) - (1/2)^n(-n-1)$

ii) $x(n) = n(1/2)^n u(n)$ **(10 Marks)**

OR

10 a. What is Z-transform? Determine Z-transform and its ROC of the following signals

i) x(n) = u(n) ii) x(n) = cos (w n) u(n) **(08 Marks)**

b. Determine inverse Z-transform of the following signal

$x(z) = \frac{1}{1 - \frac{3}{2}z^{-1} - 1 + \frac{1}{2}z^{-2}}$ for i) $|z| > 1$ ii) $|z| < \frac{1}{2}$ iii) $\frac{1}{2} < |z| < 1$ **(08 Marks)**

c. Step response of a LTI system is found to be $y(n) = 2(1/3)^n u(n)$. Find out impulse of the system. **(04 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

18EC46

Fourth Semester B.E. Degree Examination, Dec.2024/Jan.2025

Microcontroller

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Differentiate between micro-processor and microcontroller with respect to their architecture and instructor. **(08 Marks)**

b. Explain the significance of process status word. Briefly discuss PSW register of 8051. **(06 Marks)**

c. Explain the functions of the following pins of 8051 i) EA ii) ALE iii) RST. **(06 Marks)**

OR

2 a. With the help of neat diagram, explain the internal block diagram of 8051. **(10 Marks)**

b. Briefly explain the dual functions of port 3 pins of 8051. **(04 Marks)**

c. With the help of diagram, explain how to interface 8 KB EPROM and 8K RAM to 8051 micro-controller. **(06 Marks)**

Module-2

3 a. Explain with examples the different addressing modes used in 8051. **(08 Marks)**

b. Explain the operations of the 8051 instructions
i) DAA ii) MUL AB **(08 Marks)**

c. Explain the different types of jump instructions in 8051. **(04 Marks)**

OR

4 a. Name the addressing modes of the following instruction and give an example for each.
i) CJNE dest, source target
ii) ACALL target
iii) DJNZ R1, rel
iv) SWAP A
v) DA A **(04 Marks)**

b. Explain with examples the PUSH and POP instructions. **(08 Marks)**

c. Explain the operations performed by the following instructions.
i) MOVC A, @ A + DPTR ii) SWAP A iii) XCHD A, @ Rp iv) MUL AB. **(08 Marks)**

Module-3

5 a. Write an ALP in 8051 to count number of positive and negative numbers present in the internal memory block starting with address 20H, containing N bytes. Store the counts after the last data byte in the memory block. **(12 Marks)**

b. Write a program in 8051 to find the sum of 20 bytes of data stored in an array of external RAM staring with address 2000H. Store the 16 bit sum at the end of array. **(08 Marks)**

OR

6 a. Write an ALP to reach the given byte in the list of 50 numbers stored in consecutive memory locations 2000H. Assume that byte is 76H. If byte is not found store 00 at 2300 H and 2301H, if found store its address. **(08 Marks)**

b. Write an ALP to find Fibonacci series of N given terms. **(06 Marks)**

c. Write a program segment to realize the following :

i) Exchange contents of external data memory 8100 h with contents of internal data memory 40 h.

ii) Exchange contents of A-register and B-register using stack. **(06 Marks)**

Module-4

7 a. Explain Mode – 1 programming of timers in 8051. **(05 Marks)**

b. Write an ALP and C program to generate a frequency of 100 Hz square wave, using timer 0 in mode 1. Assume crystal frequency is 11.0592MHz. **(10 Marks)**

c. What is serial communication? Explain function of RS232C pins of DB-9 connector. **(05 Marks)**

OR

8 a. Write on 8051 assembly language program to transfer the message "HELLO" serially at 9600 baud, 8 bit data, 1 stop bit. **(08 Marks)**

b. Explain the importance of TI and RI flags. **(06 Marks)**

c. Write an 8051 C program to toggle all bits of port 0 continuously. Use time '0' generate the delay of 1 sec between each toggle. **(06 Marks)**

Module-5

9 a. Write an 8051 C to display the message 'VERY GOOD' on LCD display and show the interfacing circuit with functional pins of LCD. **(10 Marks)**

b. Interface a 4 × 4 keys keyboards to 8051 and write an ALP to send to key code to port whenever a key is pressed. **(10 Marks)**

OR

10 a. Interface 8 bit, 8 channel ADC to 8051. Write an assembly language program to convert CH0, CH3 and CH7 and store result in external memory location starting from C000H. Repeat procedure for every 1 Sec. **(10 Marks)**

b. Show the interfacing of a stepper motor to 8051 and write a program to rotate stepper motor 5 rotations in clockwise direction and 10 rotations in anticlockwise direction with a delay between each step. **(10 Marks)**

* * * * *

CBCS SCHEME

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

BEC401

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

Electromagnetic Theory

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.	State and explain Coulomb's law of force between two point charges in vector form.	8	L1	CO1
	b.	Define Electric field intensity. Derive the expression for the electric field intensity at a point due to infinite line charges (Uniformly charged wire).	8	L2	CO1
	c.	Two very small conducting spheres, each of mass 1 × 10-4 kg are suspended at common point by very thin filaments of length 0.2m. A charge Q Coulomb is placed on each sphere. The electric force of repulsion separates the spheres and an equilibrium is reached when the suspending filaments make an angle of 10º. Assuming e_r = 1 , g = 9.8N/kg and negligible mass for the filaments, find Q.	4	L3	CO1
		OR			
Q.2	a.	Define Point charge and using Coulomb's Law, derive expression for electric field intensity due to a point charge.	8	L2	CO1
	b.	Let a point Q1 = 25nc be located at A(4, -2, 7) and a charge Q2 = 60nc be at B(-3, 4, -2). Find $\vec{E}$ at C(1, 2, 3). Also find direction of the electric field. Given $\varepsilon_0 = 8.854 \times 10^{-12}$ F/m.	8	L3	CO1
	c.	Two point charges of $+3 \times 10^{-9}$ C and -2×10^{-9} C are spaced two meter apart. Determine the electric field at a point which is one meter from each of the two point charges.	4	L3	CO1
		Module – 2			
Q.3	a.	State and prove Gauss Divergence theorem or divergence theorem.	8	L2	CO2
	b.	A point charge , Q = 30nc is located at the origin in Cartesian coordinates. Find the electric flux density and electric field intensity at (1, 3, -4)m.	8	L3	CO2
	c.	Derive an equation for equation of continuity (continuity of current).	4	L3	CO2
		OR			
Q.4	a.	State and prove Gauss law.	8	L2	CO2
	b.	Given that the potential field is $V = 2x^2y - 5z$. Find the potential , electric field intensity and volume charge density at point P(-4, 3, 6).	8	L3	CO2
	c.	State Gauss law in point form. Hence derive Maxwell's first equation.	4	L3	CO2

Module – 3					
Q.5	**a.**	Starting from gauss law, derive Poisson's and Laplace equation. Hence define Laplace equation in all three coordinate systems.	**4**	**L2**	**CO3**
	b.	State and prove Stoke's theorem.	**8**	**L2**	**CO3**
	c.	Find the potential and volume charge density at P(0.5 , 1.5 , 1)m in free space. Given the potential field as under. i) $V = 2x^2 - y^2 - z^2$ volt ii) $V = 6\, r\, \phi\, z$ volt.	**8**	**L3**	**CO3**
OR					
Q.6	**a.**	State and prove Biot – Savart's law.	**4**	**L1**	**CO3**
	b.	State and prove Ampere's circuital law.	**8**	**L1**	**CO3**
	c.	The magnetic field intensity is given in a certain region of space as : $\vec{H} = \left(\frac{x+2y}{z^2}\right)\hat{a}_y + \frac{2}{z}\hat{a}_z$ A/m. i) Find $\nabla \times \vec{H}$ ii) Find $\vec{J}$ iii) Use $\vec{J}$ to find total current passing through the surface , Z = 4 , $1 < x < 2$, $3 < y < 5$ in the $\hat{a}_z$ direction.	**8**	**L3**	**CO3**
Module – 4					
Q.7	**a.**	Define current element. Derive an equation for force on a differential current element in a magnetic field.	**8**	**L2**	**CO4**
	b.	A point charge Q = 18nc has a velocity of 5×10^6 m/s in the direction $\vec{a} = 0.6\,\hat{a}_x + 0.75\,\hat{a}_y + 0.3\,\hat{a}_z$. Calculate the magnitude of the force exerted on the charge by the field $\vec{B} = -3\,\hat{a}_x + 4\,\hat{a}_y + 6\,\hat{a}_z$ mT.	**8**	**L3**	**CO4**
	c.	Calculate the force on a straight conductor of length 0.3m carrying a current 5A in the Z – direction where the magnetic field is $\vec{B} = 3.5 \times 10^{-3}\,(a\hat{x} - a\hat{y})$ Tesla. ($a\hat{x}$ and $a\hat{y}$ are unit vectors).	**4**	**L3**	**CO4**
OR					
Q.8	**a.**	Derive magnetic boundary condition for i) Tangential component of magnetic field. ii) Normal component of magnetic field.	**8**	**L2**	**CO4**
	b.	A conductor 4m long lies along the Y – axis with a current of 10A in the $a\hat{y}$ direction. Find the force on the conductor if the field in the region is $\vec{B} = 0.05\, a\hat{x}$ tesla.	**8**	**L3**	**CO4**
	c.	Find the magnetic field intensity inside a magnetic material for following conditions : M = 100A/m and $\mu = 1.5 \times 10^{-5}$ H/m B = 200μT , X_m (Magnetic susceptibility = 15).	**4**	**L3**	**CO4**

		Module – 5			
Q.9	**a.**	Derive Integral and point form of Faraday's law.	**8**	**L2**	**CO5**
	b.	Given $\vec{E} = E_m \sin(wt - \beta z)\ \hat{ay}$ in free space. Calculate $\vec{D}$, $\vec{B}$ and $\vec{H}$.	**8**	**L3**	**CO5**
	c.	A copper disc 40cm diameter is rotated at 3000 r.p.m on a horizontal axis perpendicular to and through the centre of disc axis, lying in magnetic meridian. Two brushes make contact with the disc at diametrically opposite points on the edge. If horizontal component of earth's field is 0.02 mT, find the induced e.m.f between brushes.	**4**	**L3**	**CO5**
		OR			
Q.10	**a.**	State and derive Poynting's theorem for uniform plane waves.	**8**	**L2**	**CO5**
	b.	Derive general wave equation in electric and magnetic fields.	**8**	**L2**	**CO5**
	c.	For silver, the conductivity is $\sigma = 3.0 \times 10^6$ s/m. At what frequency will depth of penetration be 1mm?	**4**	**L3**	**CO5**

* * * * *

CBCS SCHEME

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

BEC402

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

Principles of Communication Systems

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.**	Define probability. Illustrate the relationship between sample space, events and probability.	**06**	**L1**	**CO1**
	b.	Outline random processes and illustrate an ensemble of sample function with a neat diagram.	**06**	**L2**	**CO1**
	c.	Show that if a Gaussian process x(t) is applied to a stable linear filter, then the random process y(t) developed at the output of the filter is also Gaussian.	**08**	**L3**	**CO2**
		OR			
Q.2	**a.**	What is conditional probability? Prove that $P(B/A) = P(A/B) \cdot P(B) / P(A)$	**06**	**L1**	**CO1**
	b.	Define mean, correlation and covariance function.	**06**	**L2**	**CO2**
	c.	Develop a program to generate the probability density function of Gaussian distribution function.	**08**	**L3**	**CO2**
		Module – 2			
Q.3	**a.**	An antenna has an impedance of 40 Ω an unmodulated AM signal produces a current of 4.8 A. The modulation is 90 percent calculate i) The carrier power ii) The total power iii) The sideband power	**06**	**L1**	**CO1**
	b.	Explain with neat diagrams amplitude demodulation using the diode detector.	**07**	**L1**	**CO1**
	c.	Explain a general block diagram of an FDM system	**07**	**L2**	**CO2**
		OR			
Q.4	**a.**	Interpret the concept of modulation index and percentage of modulation write the necessary equations.	**06**	**L1**	**CO1**
	b.	Explain high level collector modulation with neat block diagram.	**07**	**L2**	**CO1**
	c.	Explain with diagrams the working principle of lattice type balanced modulator.	**07**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	Compare and contrast FM and AM.	**06**	**L1**	**CO1**
	b.	Explain with diagrams the working principle of frequency modulation using voltage controlled oscillator.	**07**	**L2**	**CO2**
	c.	Explain general block diagram of a super heterodyne receiver.	**07**	**L2**	**CO2**
		OR			
Q.6	**a.**	The input to an FM receiver having an S/N of 2.8. The modulating frequency is 1.5 KHz. The maximum permitted deviation is 4 KHz. What are (i) The frequency deviation caused by the noise (ii) The improved output S/N.	**06**	**L2**	**CO2**
	b.	Define PLL. Explain the basic block diagram of a PLL.	**07**	**L1**	**CO2**
	c.	Explain JFET mixer.	**07**	**L2**	**CO2**

		Module – 4			
Q.7	**a.**	What are the advantages of digital signal over analog signals?	**04**	**L1**	**CO1**
	b.	Explain with basic elements of a PCM system with neat diagrams.	**08**	**L2**	**CO1**
	c.	For the data stream 0 1 1 0 1 0 0 1 draw the following line code waveforms i) Unipolar NRZ ii) Polar NRZ iii) Unipolar RZ iv) Manchestor code	**08**	**L3**	**CO2**
		OR			
Q.8	**a.**	State and prove Sampling theorem.	**04**	**L1**	**CO1**
	b.	What is multiplexing and why is it required in communication? Explain the working of TDM with a neat block diagram.	**08**	**L2**	**CO1**
	c.	Explain the generation of PPM with a relevant block diagrams and waveforms.	**08**	**L2**	**CO2**
		Module – 5			
Q.9	**a.**	Define Intersymbol interference (ISI) outline baseband binary data transmission system with neat block diagram and equations.	**08**	**L2**	**CO1**
	b.	Develop a code to generate RZ pulse.	**04**	**L3**	**CO2**
	c.	Define signal to noise ratio. Explain different types of external and internal noise.	**08**	**L2**	**CO1**
		OR			
Q.10	**a.**	Explain the following concept briefly: i) Nyquist criterion for distributors transmission ii) Baseband M-ary PAM transmission	**08**	**L1**	**CO2**
	b.	Develop a code to generate Raised cosine pulse.	**04**	**L2**	**CO2**
	c.	Illustrate the concept of noise in cascaded stages with a diagram. Write Friis formula and mention its terms.	**08**	**L2**	**CO3**

* * * * *

CBCS SCHEME

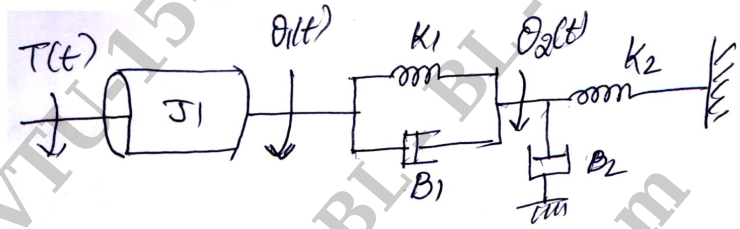
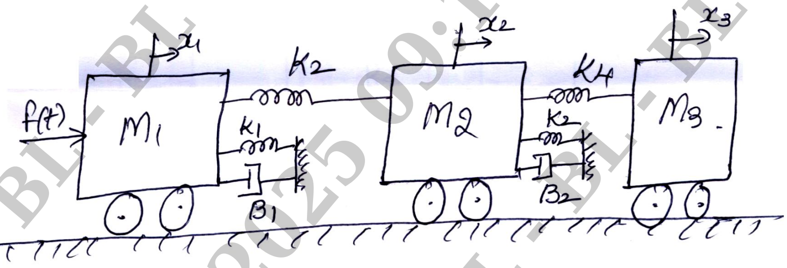
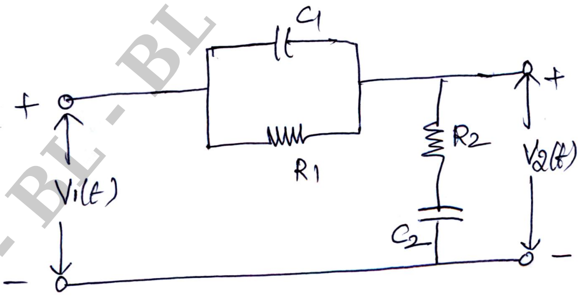
USN | | | | | | | | | | |

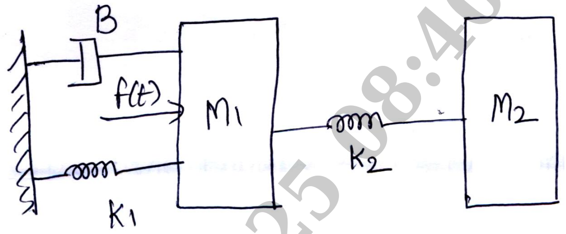
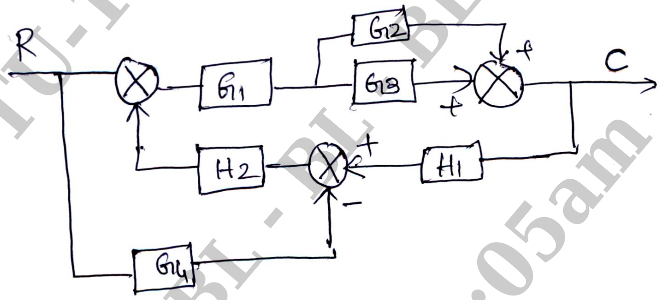
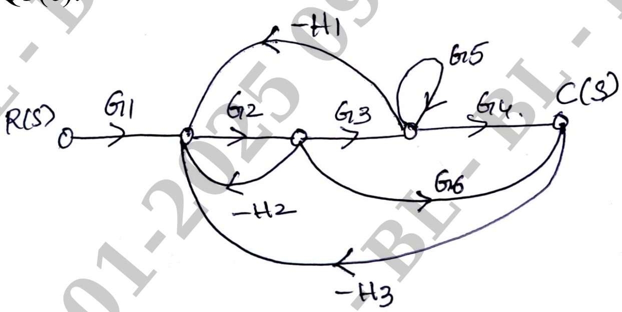
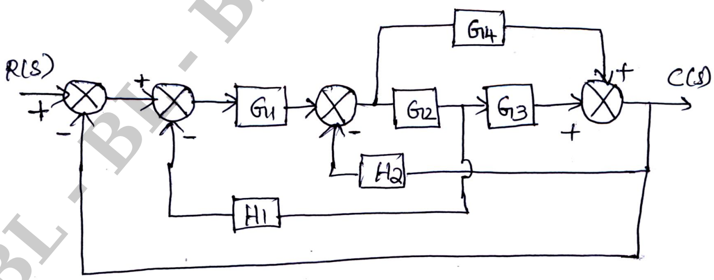
BEC403

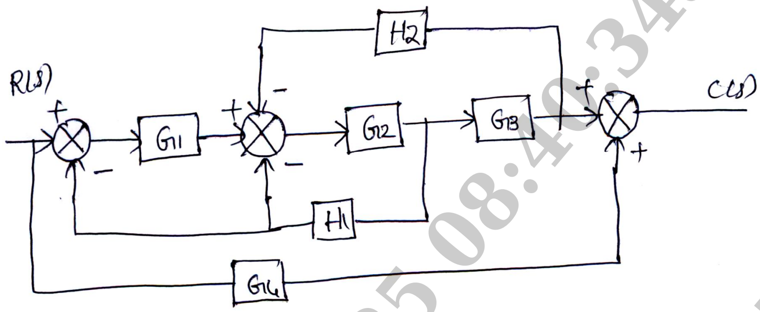
Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Control Systems

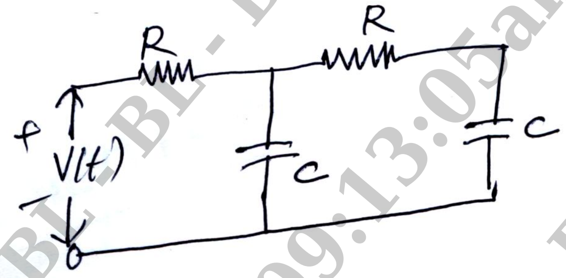
Time: 3 hrs. Max. Marks: 100

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.	Compare open loop and closed loop control system with practical example.	06	L2	CO1
	b.	For the system shown in Fig.Q1(b). Find the transfer function $G(s) = \frac{\theta_2(s)}{T(s)}$ consider J_1 = 1 kgm^2, K_1 = 1 Nm/rad, K_2 = 1 Nm/rad, B_1 = 1 Nm/rad/sec, B_2 = 1 Nm/rad/sec.  Fig.Q1(b)	06	L2	CO1
	c.	Draw the mechanical network for the system shown in Fig.Q1(c). Write the equations of performance and draw its analogous circuit based one force voltage analogy.  Fig.Q1(c)	08	L2	CO1
		OR			
Q.2	a.	The circuit shown in Fig.Q2(a) is called lead-lag filter. Find the transfer function $\frac{V_2(s)}{V_1(s)}$ when R_1 = 100 Ω, R_2 = 200 KΩ, C_1 = 1 μF and C_2 = 0.1 μF.  Fig.Q2(a)	10	L3	CO1

	b.	What are the variables and elements of translational motion? For the mechanical system shown in Fig.Q2(b). (i) Write the differential equations of performance. (ii) Draw and write loop and nodal equations based on F-V and F-I analogous networks.  Fig.Q2(b)	**10**	**L2**	**CO2**
		Module – 2			
Q.3	**a.**	Give any six block diagram reduction rules to find the transfer function of the system.	**04**	**L1**	**CO2**
	b.	For the system represented in the given Fig.Q3(b), determine transfer function C(s)/R(s).  Fig.Q3(b)	**06**	**L2**	**CO1**
	c.	Find the overall transfer function of the system whose signal flow graph is shown in Fig.Q3(c).  Fig.Q3(c)	**10**	**L2**	**CO2**
		OR			
Q.4	**a.**	Interpret the transfer function by converting the block diagram into signal flow graph.  Fig.Q4(a)	**10**	**L2**	**CO2**

	b.	Obtain the transfer function for the block diagram shown in Fig.Q4(b) using block diagram reduction technique.  Fig.Q4(b)	**10**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	Make use of the response curve of 2^{nd} order under-damped system to define and derive the expression for (i) peak time (ii) peak overshoot (iii) rise time	**10**	**L2**	**CO3**
	b.	Find K_p, K_v and K_a for a system having $G(s)=\frac{s+10}{s(s^3+7s^2+12s)}$. Also, evaluate the steady state error, when the I/P r(t) is given by: (i) $r(t) = 5u(t)$ (ii) $r(t) = 2t\,u(t)$ (iii) $r(t) = 4t^2u(t)$	**10**	**L2**	**CO3**
		OR			
Q.6	**a.**	Derive an expression for the under damped response of a second order feedback control system for step input.	**10**	**L2**	**CO2**
	b.	Explain the static error constant and derive the expressions.	**06**	**L2**	**CO2**
	c.	Analyze the effect of PD controller for 2^{nd} order control system with appropriate equations.	**04**	**L2**	**CO2**
		Module – 4			
Q.7	**a.**	The open loop transfer function of a unity feedback system is given by $G(s)=\frac{K}{s(s+3)(s^2+s+1)}$. Find the valve of K that will cause sustained oscillation and hence find the oscillation frequency.	**08**	**L2**	**CO3**
	b.	Sketch the root locus plot for a negative feedback control system whose open loop transfer function is given by $G(s)H(s)=\frac{K}{s(s+1)(s+2)(s+3)}$. For all values of K ranging from 0 to α. Find the value of K for closed loop stability.	**12**	**L3**	**CO3**
		OR			
Q.8	**a.**	For the characteristic equations given below, determine number of roots with positive real part: i) $s^6+s^5+3s^4+2s^3+5s^2+3s+1=0$ ii) $s^8+s^7+4s^6+3s^5+14s^4+11s^3+20s^2+9s+9=0$	**10**	**L2**	**CO4**

	b.	Show that the part of root locus of a system with $G(s)H(s)=\dfrac{K(s+3)}{s(s+2)}$ is a circle having center (–3, 0) and radius at $\sqrt{3}$.	**10**	**L3**	**CO3**
		Module – 5			
Q.9	**a.**	Construct the bode plot for the transfer function $G(s)=\dfrac{80}{s(s+2)(s+20)}$. Determine GM and PM, ω_{pc}, ω_{gc}.	**10**	**L2**	**CO3**
	b.	Obtain the state transmition matrix for the following system: $\begin{bmatrix} x_1^1 \\ x_2^1 \end{bmatrix}=\begin{bmatrix} -1 & -0.5 \\ 1 & 0 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}+\begin{bmatrix} 0.5 \\ 0 \end{bmatrix}u$	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Using Nyquist stability criteria investigate the stability negative feedback control system whose open loop transfer function is given by $G(s)H(s)=\dfrac{100}{(s+1)(s+2)(s+3)}$. Assume $\omega_g = 1.253$ rad/sec.	**10**	**L2**	**CO5**
	b.	Obtain the state model of electrical network shown in Fig.Q10(b), by choosing $V_1(t)$ and $V_2(t)$ as state variables.  Fig.Q10(b)	**10**	**L3**	**CO5**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

BEC405A

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

Microcontrollers

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.	Bring out the difference between Microprocessor and Microcontroller.	04	L2	CO1
	b.	With function of each pin, explain the pin layout of 8051 Microcontroller.	10	L2	CO1
	c.	Summarize the internal RAM configuration of 8051.	06	L2	CO1
		OR			
Q.2	a.	Differentiate between CISC and RISC processor architectures.	04	L2	CO1
	b.	With a neat architecture, explain the architectural features of 8051.	08	L2	CO1
	c.	Interface 8051 microcontroller to 16K bytes of EPROM and 8K bytes of RAM. Explain with neat sketch.	08	L3	CO1
		Module – 2			
Q.3	a.	What is an addressing mode? Explain 4 different addressing modes of 8051 with examples.	08	L2	CO2
	b.	Illustrate with a neat diagram different ranges of jump instructions.	06	L2	CO2
	c.	Write an ALP to convert a packed BCD number into two ASCII numbers. Store the result in R5 and R6 respectively.	06	L2	CO2
		OR			
Q.4	a.	Define assembler directives. Explain the same with examples.	08	L2	CO2
	b.	List and explain bit level logical instructions in 8051.	06	L2	CO2
	c.	Develop an assembly language program to swap the contents of R3 and R4 registers in BANKO using different methods.	06	L2	CO2
		Module – 3			
Q.5	a.	Explain the bit contents of TCON and TMOD registers.	06	L2	CO3
	b.	Develop an ALP to generate a square wave of frequency 1 kHz on Pin P1.2 using Timer 0 in mode 2. Show the delay calculation. Assume XTAL frequency = 22 MHz.	06	L3	CO3
	c.	Explain RS232 in serial communication using 8051 Microcontroller with DB-9 pin connector.	08	L2	CO3
		OR			
Q.6	a.	Explain the bit pattern of SCON register with diagram.	04	L2	CO3
	b.	Develop an 8051 C program to transfer letter "A" serially at 9600 baud rate, 8 bit data, 1 stop bit, do this continuously.	08	L3	CO3
	c.	Explain Mode 2 operations of timers and explain steps involved in programming timer in Mod 2, with necessary diagram.	08	L2	CO3
		Module – 4			
Q.7	a.	Explain the structure of interrupt priority and interrupt enable register.	08	L2	CO4
	b.	Explain interrupt vector table of 8051 Microcontroller.	06	L2	CO4
	c.	Explain programming of Timer interrupts.	06	L2	CO4

		OR			
Q.8	**a.**	List the steps involved in executing an interrupt.	**04**	**L2**	**CO4**
	b.	Write an ALP program using interrupts to generate a square wave on port pin P1.2 of 10 kHz using timer 0 in mode 2, XTAL = 22 MHz.	**08**	**L3**	**CO4**
	c.	Explain the steps involved in programming serial communication interrupts.	**08**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	With a neat diagram, write an 'C' language program to interface DAC to 8051 Microcontroller to generate staircase waveform with 20 steps.	**10**	**L3**	**CO5**
	b.	Explain the interfacing of DC motor using C programming.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	With neat diagram, write an C language program to interface stepper motor to 8051 Microcontroller.	**10**	**L3**	**CO5**
	b.	Write a C program to display 'HELLO WORLD' by interfacing LCD display to 8051 Microcontroller.	**10**	**L3**	**CO5**

* * * * *

CBCS SCHEME

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

18EC52

Fifth Semester B.E. Degree Examination, Dec.2024/Jan.2025
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. Compute N-point DFT of the following signals :
i) $x(n) = a^n$, $0 \le n \le N-1$
ii) $x(n) = 1$, $0 \le n \le N-1$. **(10 Marks)**

b. Determine 4-point circular convolution of the sequences.
$x_1(n) = \{2, 1, 2, 1\}$ and $x_2(n) = \{1, 2, 3, 4\}$ using graphical method. **(05 Marks)**

c. Compute the DFT of the sequence defined by $x(n) = (-1)^n$ for i) N = 3 ii) N = 4. **(05 Marks)**

OR

2 a. Illustrate the following properties of DFT :
i) Linearly
ii) Circular time shift **(10 Marks)**

b. Compute the IDFT of 4-point sequence :
$X(K) = \{4, -j2, 0, J2\}$ using DFT. **(10 Marks)**

Module-2

3 a. Develop radix – 2 decimation – in – time FFT algorithm and write signal flow graph for N = 8. **(10 Marks)**

b. i) Compute the 4-point DFT of the sequence $x(n) = \{1, 0, 1, 0\}$ using DIT FFT radix – 2 algorithm.
ii) Find x(n) for X(K) found in part(i) by DIF FFT algorithm. **(10 Marks)**

OR

4 a. Find the o/p y(n) of a filter whose impulse response is $h(n) = \{3, 2, 1, 1\}$ and input $x(n) = \{1, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1\}$ using overlap – add method assuming the length of block is 7. **(10 Marks)**

b. Explain overlap-save method to find the output of the filter. **(10 Marks)**

Module-3

5 a. Explain any three window functions to design FIR filters. **(10 Marks)**

b. A lowpass filter is to be designed with the following desired frequency response

$$H_d(e^{jw}) = H_d(w) = \begin{cases} e^{-j2w}, & |w| < \frac{\pi}{4} \\ 0, & \frac{\pi}{4} |w| < \pi \end{cases}$$

Determine the filter coefficients $h_d(n)$ and h(n) if w(n) is a rectangular window defined as follows :

$$w_R(n) \begin{cases} 1, & 0 \le n \le 4 \\ 0, & \text{otherwise} \end{cases}$$

Also, find the frequency response, H(w) of the resulting FIR filter. **(10 Marks)**

OR

6 a. Realize the FIR filter whose impulse response is given by

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

b. Consider a three stage FIR Lattice structure having the co-efficient $K_1 = -0.65$, $k_2 = -0.34$ and $k_3 = 0.8$. Realize this filter in direct form. **(10 Marks)**

Module-4

7 a. Compare IIR filter with FIR filter. **(10 Marks)**

b. Derive an expression for the order of analog Butterworth prototype low pass filter. **(10 Marks)**

OR

8 a. Design an Buterworth filter for which gain $K_p = 0.5$, $K_s = 0.1$ and passband frequency is 2 rad/sec, stopband frequency is 10 rad/sec. **(10 Marks)**

b. Draw the block diagrams of direct form – I realizations for a digital IIR filter described by the system function :

$$H(z) = \frac{8z^3 - 4z^2 + 11z - 2}{\left(z - \frac{1}{4}\right)\left(z^2 - z + \frac{1}{2}\right)}.$$ **(10 Marks)**

Module-5

9 a. Discuss briefly the following DSP hardware units :
i) MAC unit ii) Shifter iii) Address generators. **(10 Marks)**

b. Convert the following decimal numbers into Q – 15 representation :
i) 0.560123 ii) 0.160123. **(10 Marks)**

OR

10 a. Explain briefly the basic architecture of TMS320C54X family processor. **(10 Marks)**

b. Discuss the following IEEE floating – point formats
i) Single precision format
ii) Double precision format. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

18EC53

Fifth Semester B.E. Degree Examination, Dec.2024/Jan.2025
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. Explain the generation of amplitude modulated (AM) waves using switching modulator. **(08 Marks)**

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

c. An audio signal 10 sin 1000 π t volts is used to amplitude modulate a carrier signal 75 sin $(2\pi \times 10^6)$t. Assume modulation index as 0.5. Find :

i) Side band frequencies
ii) Amplitude of each side band
iii) The bandwidth required
iv) The total power delivered to a load of 100Ω. **(05 Marks)**

OR

2 a. With a neat block diagram and equations, explain the generation and demodulation of VSB signals. **(08 Marks)**

b. Fig.Q2(b) shows the block of an AM system with $s(t) = A_C[1 + K_a m(t)]\cos(2\pi f_c t)$ and $|K_a m(t)| < 1$ for all t. If m(t) is a band limited signal in the interval $(-w < f < w)$ and $f_c > 2w$ show that m(t) can be obtained from the square rooter output.

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

c. Explain in detail the scheme of FDM. **(05 Marks)**

Module-2

3 a. Derive the equation of FM wave and list the properties of angle modulated waves. **(07 Marks)**

b. Obtain the time domain expression of NBFM wave plot its spectrum and compare with AM using phasor diagrams. **(08 Marks)**

c. An angle modulated wave is defined by the equation :
$s(t) = 10\cos[2\pi \times 10^6 t + 5\sin(2000\pi)t + 10\sin(3000\pi)t]$
determine the following :
i) Power in the modulated signal across a standard 1Ω resistor
ii) Frequency deviation
iii) The deviation ratio
iv) Phase deviation
v) Transmission bandwidth. **(05 Marks)**

OR

4 a. With a neat block diagram and necessary equations explain the demodulation of FM waves using non-linear model of phase locked loop (PLL). **(08 Marks)**

b. Draw the block diagram of super heterodyne receiver from AM reception and explain the functions of each block. **(06 Marks)**

c. An FM signal $s(t) = A_c \cos\left[2\pi f_c t + 2\pi k_f \int_0^t m(t)dt\right]$ is a applied to a system consisting of RC high pass filter and envelope detector shown in Fig.Q4(c). Assume $R << X_C$ and envelope detector does not load the filter, determine the envelope detector output assuming $k_f|m(t)| < f_c$ for all t. Comment on the output.

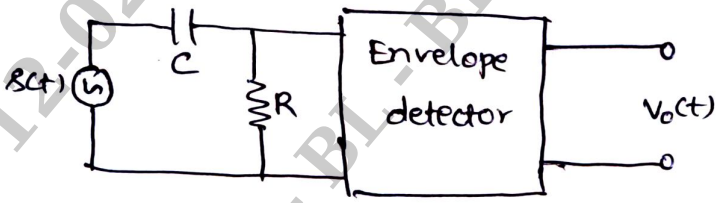


Fig.Q4(c) **(06 Marks)**

Module-3

5 a. Explain thermal noise and white noise. **(06 Marks)**

b. Define noise equivalent bandwidth and derive the expression for the same. **(08 Marks)**

c. An amplifier operating over a frequency 2 range of 450 to 460 KHz is having an input resistance of 10 KΩ. If the temperature is 15°C. Find :
i) rms noise voltage at the input of the amplifier
ii) the amplifier noise power
iii) the power spectral density. **(06 Marks)**

OR

6 a. Starting from fundamentals, derive the expression for Figure of Merit (FOM) of an AM receiver operating on single tone modulation. **(10 Marks)**

b. Discuss the noise in FM receivers and obtain the expression for Figure of Merit (FOM) for FM receiver. **(10 Marks)**

Module-4

7 a. Mention the advantages of digitalizing analogy signals. **(04 Marks)**

b. With relevant equations, state and explain sampling theorem for low pass signals and derive the interpolation formula. **(10 Marks)**

c. With a neat block diagram, explain the generation of Pulse Position Modulation (PPM) signals. **(06 Marks)**

OR

8 a. Mention the few applications of pulse amplitude modulation (PAM). **(04 Marks)**

b. Consider the signal $x(t) = 5\cos(2000\pi t) + 10\cos(6000\pi t)$
i) What is the Nyquist rate and Nyquist interval
ii) Assume if the signal is sampled at frequency $f_s = 5000$ Hz ; what is the resulting signal
iii) Draw the spectrum of the sampled signal for $f_s = 5000$ Hz. **(10 Marks)**

c. With a neat block diagram, explain Time Division Multiplexing Technique(TDM). **(06 Marks)**

Module-5

9 a. A PCM system uses uniform quantizer followed by a N bit encoder. Show that rms signal to quantization noise is approximately given by $[SNR]_{0dB} = (4.8 + 6N)dB$. **(08 Marks)**

b. Explain the generation and reconstruction of PCM signal. **(06 Marks)**

c. A TV Signal with a bandwidth of 4.2MHz is transmitted using binary PCM. The number of representation levels are 512 calculate :

i) Code word length

ii) Final bit rate

iii) Transmission band width. **(06 Marks)**

OR

10 a. For the bit sequence 10011101 draw unipolar NRZ, polar NRZ, unipolar RZ, bipolar RZ and Manchester encoding formats. **(08 Marks)**

b. Explain Delta modulation with relevant equations and waveforms. **(06 Marks)**

c. With a neat block diagram, explain the working of linear predictive vocoder. **(06 Marks)**

* * * * *

CBCS SCHEME

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

18EC54

Fifth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Information Theory and Coding

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. Discuss the reasons for using logarithmic measure of measuring the amount of information. **(06 Marks)**

b. A source transmits two independent messages with probabilities of p and (1-p) respectively. Prove that the entropy is maximum when both the messages are equally likely. Plot the variations of entropy (H) as a function of probability 'p' of the messages. **(04 Marks)**

c. Find G_1 and G_2 and verify that $G_1 > G_2 > H(s)$ for the Fig.Q1(c). **(10 Marks)**

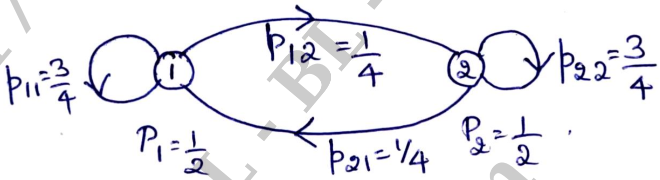


Fig.Q1(c)

OR

2 a. Define the following with respect to information theory :
i) Self information
ii) Entropy
iii) Rate of information. **(06 Marks)**

b. An analog signal is band limited to 500 Hz and is sampled at "Nyquist rate". The samples are quantized into 4 levels and each level represent one message. The quantization levels are assumed to be independent. The probabilities of occurrence of 4 levels are $P_1 = P_4 = \frac{1}{8}$ and $P_2 = P_3 = \frac{3}{8}$ find the information rate of the source. **(04 Marks)**

c. The state diagram of the Mark off source is as shown in the Fig.Q2(c). Find :
i) The entropy of each state H_i
ii) The entropy of source H
iii) G_1, G_2 and $H(G_1 |> G_2 > H)$. **(10 Marks)**

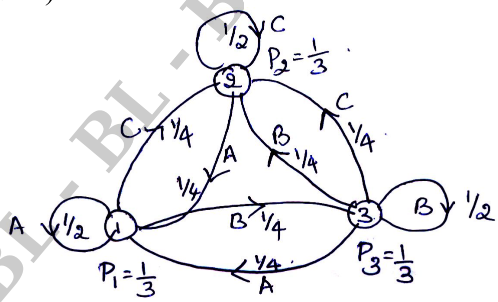


Fig.Q2(c)

Module-2

3 a. A DMS has an alphabet $S = \{s_0, s_1, s_2, s_3, s_4, s_5, s_6\}$ and source statistics P = {0.125, 0.0625, 0.25, 0.0625, 0.125, 0.125, 0.25}. Construct binary Huffman code. Also find the efficiency and redundancy of coding. **(10 Marks)**

b. Explain prefix coding with an example. Also explain the properties of prefix codes. **(10 Marks)**

OR

4 a. Explain Shannon's encoding algorithm. State the properties of Shannon's encoding algorithm. **(10 Marks)**

b. Apply Shannon – Fano encoding algorithm to the following set of messages and obtain the entropy and efficiency.

Message	m_1	m_2	m_3	m_4	m_5	m_6	m_7	m_8
Probability of message	$\frac{16}{32}$	$\frac{4}{32}$	$\frac{4}{32}$	$\frac{2}{32}$	$\frac{2}{32}$	$\frac{2}{32}$	$\frac{1}{32}$	$\frac{1}{32}$

(10 Marks)

Module-3

5 a. Prove that the mutual information of the channel is symmetric i.e. $I(X;Y) = (Y;X)$. **(08 Marks)**

b. Two noisy channels are cascaded whose channel matrices are given by,

$$p(y_j \mid x_i) = \begin{bmatrix} \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ \frac{1}{2} & \frac{1}{4} & \frac{1}{4} \end{bmatrix} \text{ and } p(z_j \mid y_i) = \begin{bmatrix} \frac{1}{3} & \frac{2}{3} & 0 \\ \frac{2}{3} & 0 & \frac{1}{3} \\ 0 & \frac{1}{3} & \frac{2}{3} \end{bmatrix}$$

With $P(x_1) = P(x_2) = 0.5$. Show that $I(X ; Y) > I(X ; Z)$. **(12 Marks)**

OR

6 a. State channel capacity theorem : In the channel capacity equation when the signal power is fixed and white Gaussian noise is present, the channel capacity approaches an upper limit with increase in band width 'B'. Prove that this upper limit is given as,

$$C_\infty = \lim_{B\to\infty} C = 1.44\frac{S}{N_0}.$$ **(10 Marks)**

b. For the channel shown in Fig.Q6(b) the symbols are transmitted at the rate of 10,000 per second. Calculate maximum mutual information of this cannel. **(10 Marks)**

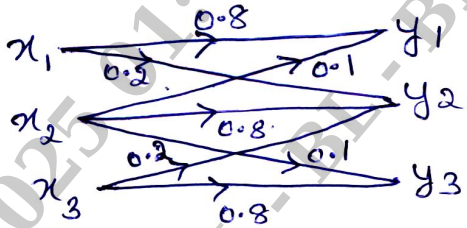


Fig.Q6(b)

Module-4

7 a. Consider a (7, 4) linear code whose generator matrix is G

$$G = \left[\begin{array}{cccc|ccc} 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{array}\right]$$

Find :

i) All the code vectors of this code

ii) Parity check matrix of this code

iii) The maximum weight of this code. **(10 Marks)**

b. The generator polynomial for a(15, 7) cyclic code is $G(x) = 1 + x^4 + x^6 + x^7 + x^8$.

i) Find the code vector in systematic form for the message $D(x) = x^2 + x^3 + x^4$

ii) Assume that the first and last bit of the code vector V(x) for $D(x) = x^2 + x^3 + x^4$ suffer transmission errors. Find the syndrome of V(x). **(10 Marks)**

OR

8 a. For a(5, 2) linear, systematic block code, choose the generator matrix and parity check matrix with the objective of maximizing d_{min}. For the matrix chosen, construct the standard array. **(10 Marks)**

b. Consider a(6, 3) linear block code whose

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

i) Find all the code vector
ii) Find all Hamming weight and distance
iii) Find minimum weight parity check matrix
iv) Draw encoder circuit for above code. **(10 Marks)**

Module-5

9 a. Consider (3, 1, 2) convolution encoder with impulse response

$g_1^{(1)} = \{1\ 1\ 0\}$, $g_1^{(2)} = \{1\ 0\ 1\}$, $g_1^{(3)} = \{1\ 1\ 1\}$

i) Draw the encoder block diagram
ii) Find the generator matrix and output code vector for m = {1 1 1 0 1}.
iii) Find the code vector corresponding to the message sequence using time domain approach. **(12 Marks)**

b. Write a note on Viterbi algorithm for decoding of convolutional codes. **(08 Marks)**

OR

10 a. For the convolutional encoder of Fig.Q10(a) determine the following :
i) Dimension of the code
ii) Code rate
iii) Constraint length
iv) Generating sequences (impulse responses)
v) Output sequence for message sequence of m = {1 0 0 1 1} using transfer domain approach. **(08 Marks)**

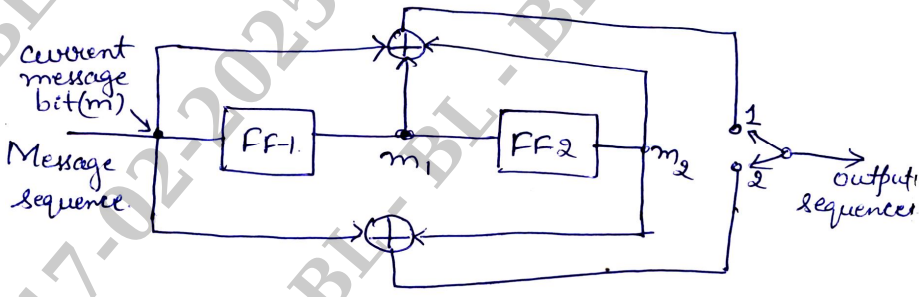


Fig.Q10(a)

b. A rate 1/3 convolution encoder has generating vectors as :
$g_1 = (1\ 0\ 0)$, $g_2 = (1\ 1\ 1)$, $g_3 = (1\ 0,\ 1)$
i) Sketch the encoder configuration
ii) State diagram and code tree
iii) If input message sequence is 10110, determine the output sequence of the encoder using code tree. **(12 Marks)**

* * * * *

USN | | | | | | | | | |

18EC55

Fifth Semester B.E. Degree Examination, June/July 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 derive Coulomb's law. **(06 Marks)**

b. Find the force on charge Q_1 located at (4, -2, 1) m due to charge Q_2 located at (3, -1, -2) m. $Q_1 = 200\ \mu C$, $Q_2 = 300\ \mu C$. **(07 Marks)**

c. Calculate the electric field intensity E at (-1, 3, -2) m due to infinite line charges with $\rho_1 = 25$ nC/m lying along x-axis and $\rho_1 = 50$ nC/m lying along y-axis. **(07 Marks)**

OR

2 a. Derive electric field intensity E due to infinite line charge. **(06 Marks)**

b. Two point charges $Q_1 = 5\ \mu C$ and $Q_2 = -3\ \mu C$ are located in free space at (1, 0, -2) m and (-2, 1, 3) m respectively. Find electric field intensity E at P(-3, 2, -1) m. **(07 Marks)**

c. Calculate the electric field intensity E at (-2, 1, -3) m due to infinite sheet charges :

$\rho_S = \frac{1}{6\pi} nC/m^2$ located at y = 3 m and

$\rho_S = \frac{1}{3\pi} nC/m^2$ located at z = -5 m **(07 Marks)**

Module-2

3 a. State and prove Gauss law. **(06 Marks)**

b. Given $D = \frac{5r^3}{y} a_r C/m^2$ in cylindrical co-ordinates. Prove divergence theorem for the volume enclosed by r = 2m, r = 3 m, z = 0 and z = 5 m. **(07 Marks)**

c. Find the total charge in a volume defined by six planes for which, $2 \le x \le 3$, $3 \le y \le 4$, $4 \le z \le 5$, if $D = 5x^2 a_x + 4y^2 a_y + 3za_z$ C/m². **(07 Marks)**

OR

4 a. Using Gauss's law, derive the expressions for $\overline{D}$ and $\overline{E}$ due to co-axial cylindrical conductors. **(06 Marks)**

b. Calculate the total electric flux density due to two uniform line charges of 30 μC/m lying along x-axis and 50 μC/m lying along z-axis, at (2, 3, 4)m. **(07 Marks)**

c. In an electric field, potential field is $V = 5x^2 + 3y^3 + 8z$ volts. Find

(i) $\overline{E}$ (ii) $|E|$ (iii) $\overline{D}$ at (-3, 2, 4) m **(07 Marks)**

Module-3

5 a. Using Laplace's equation, derive the expression for potential (V) and electric field strength E due to two concentric cylinders of infinite length. **(06 Marks)**

b. In spherical co-ordinates V = 750 volts at r = 25 cm and E = 825 a_r V/m at r = 75 cm. Determine the location of voltage reference if potential depends only on r. **(07 Marks)**

c. State and prove Ampere's circuital law. **(07 Marks)**

OR

6 a. Using Biot-Savart's law, derive the expression for magnetic field intensity "H" due to infinite long conductor. **(06 Marks)**

b. In spherical co-ordinates, V = 0 for r = 0.2 m and V = 200 volts for r = 3 m. Assuming free space between concentric spheres (Shells) find electric field intensity E and flux density D. **(07 Marks)**

c. Find magnetic field intensity H at the center of a square loop of sides equal to 10 m and carrying a current of 5 amp. **(07 Marks)**

Module-4

7 a. Derive the equation for magnetic force on a differential current element in a magnetic field. **(06 Marks)**

b. Calculate the force on a straight conductor of length 0.5 m carrying a current of 10 amp in the z-direction, where $\overline{B} = 5\times10^{-3}a_x$ Tesla and $B = 6\times10^{-3}a_y$ Tesla. **(07 Marks)**

c. A solenoid with air core has 2000 turns and a length of 700 mm. Core radius is 50 mm. Find self inductance. **(07 Marks)**

OR

8 a. Derive the equation for force between two parallel current carrying conductors. **(06 Marks)**

b. Derive tangential and normal boundary conditions (magnetic) between two media of permeabilities μ_1 and μ_2. **(07 Marks)**

c. Find the inductance per unit length of a co-axial conductor with an inner radius of a = 4 mm and outer radius of b = 10 mm. Assume $\mu_r = 1$. **(07 Marks)**

Module-5

9 a. State the inconsistency of Ampere's law, for time varying fields. Derive Maxwell's equation to correct it. **(06 Marks)**

b. Derive general plane wave equation in terms of E, taking help of the Maxwell's equation (for free space). **(07 Marks)**

c. A plane wave travelling in positive z-direction in a lossless unbounded medium has permeability 5 times that of free space and a dielectric constant 3 times that of free space.

(i) Find phase velocity of the wave

(ii) If E has only x-component with amplitude 25 V/m, find amplitude and direction of H. **(07 Marks)**

OR

10 a. Prove that conduction current and displacement current are equal. **(06 Marks)**

b. State and explain Poynting theorem. **(05 Marks)**

c. Determine following parameters for a medium with $\in_r = 4$, $\mu_r = 1$, $\sigma = 20\times10^{-2}$ S/m, f = 1 mHz.

(i) Attenuation constant

(ii) Phase shift constant

(iii) Propagation constant

(iv) Wavelength

(v) Phase velocity

(vi) Intrinsic impedance

(vii) Skin depth (δ) **(09 Marks)**

* * * * *

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

18EC56

Fifth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Verilog HDL

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the typical design flow for designing VLSI IC circuits, with a neat flow chart. **(10 Marks)**

b. Explain the different levels of abstraction used for programming in verilog and write the example in each case. **(10 Marks)**

OR

2 a. Explain top-down design methodology and bottom-up design methodology with example. **(10 Marks)**

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

Module-2

3 a. Explain the lexical convention 'sized numbers and unsized numbers'. **(02 Marks)**

b. Explain the following data types with an example in verilog:
i) Registers ii) Nets iii) Arrays iv) Integers v) Time. **(10 Marks)**

c. What are system tasks and compiler directives? Explain with example. **(08 Marks)**

OR

4 a. With a neat block diagram, explain the components of a verilog module by highlighting mandatory blocks. **(08 Marks)**

b. What are the components of SR-Latch? Write verilog HDL module of SR-Latch. **(08 Marks)**

c. Write ANSI C style port declaration syntax. **(04 Marks)**

Module-3

5 a. With the help of logic diagram, write a verilog code for 4 to 1 multiplexer using gate-level modeling. **(08 Marks)**

b. What are rise, fall and turn-off delays? Explain, how they are specified in verilog. **(08 Marks)**

c. Design gate-level description for 2-to-1 multiplexer using bufif 0 and bufif 1 gates. The delay specification for these gates are as follows:

Delay	Min	Typ	Max
Rise	1	2	3
Fall	3	4	5
Turn-off	5	6	7

(04 Marks)

OR

6 a. Write a verilog data-flow level of abstraction for 4-to-1 multiplexer using i) Conditional operator ii) Logical equation. **(10 Marks)**

b. What would be output of the following:
a = 8′b10100101 b = 8′b10110111
i) a&b ii) a&&b iii) &b iv) a>>1 v) a>>>1 vi) y = {2{b}}
vii) a^ b viii) z = {b, a} ix) y = a + b x) !a **(10 Marks)**

Module-4

7 a. Explain the blocking assignment statements and non-blocking assignment statements with relevant examples. **(08 Marks)**
b. Explain the following control statement syntax with an example:
i) if-else ii) For **(08 Marks)**
c. Write a verilog HDL code for JK-flip flop using CASE statement. **(04 Marks)**

OR

8 a. Bring out the difference between task and function. **(08 Marks)**
b. Write verilog program to define a function to calculate the factorial of a 4-bit number. The output is a 32-bit value. Invoke the function by using stimulus and check results. **(08 Marks)**
c. What is task definition using ANSI c-style argument declaration? **(04 Marks)**

Module-5

9 a. Explain the terms force and release. **(06 Marks)**
b. Discuss the system tasks related to files. **(06 Marks)**
c. Using assign and deassign statements, design a positive edge-triggered D-flipflop with a synchronous clear (q = 0) and preset (q = 1). **(08 Marks)**

OR

10 a. With a neat flow chart explain basic computer-aided logic synthesis process. **(10 Marks)**
b. What will the following statement translate to when run on a logic synthesis tool:
i) assign (c_out, sum) = a + b + c_in ;
ii) assign out = (s) ? i1 : i0 ;
iii) always @ (clk or d)
    if (clk)
      q = d ; **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

21EC51

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
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. With necessary diagram, explain the generation and detection or reception of BPSK signal. **(08 Marks)**

b. Derive the expression for error probability of BFSK. **(08 Marks)**

c. Define bandwidth efficiency. Tabulate and comment on the bandwidth efficiency of m-ary PSK. **(04 Marks)**

OR

2 a. Sketch QPSK waveform for the binary data 01101000. **(08 Marks)**

b. A binary FSK system transmits binary data at a rate of 2 Mbps over AWGN channel. The noise power spectral density $\left(\frac{N_0}{2}\right) = 10^{-20}$ W/Hz. Determine the probability of error for coherent detection of FSK scheme. Assume the amplitude of the received signal as 1 μv. Consider erf (2.5) = 0.99959 or $\text{erfc}(\sqrt{625}) = 0.00041$. **(06 Marks)**

c. With a neat block diagram, explain the generation of DPSK signal. **(06 Marks)**

Module-2

3 a. For the signals $s_1(t)$, $s_2(t)$, $s_3(t)$, shown in the given Fig.Q3(a), find the set of orthonormal basis function using GSOP.

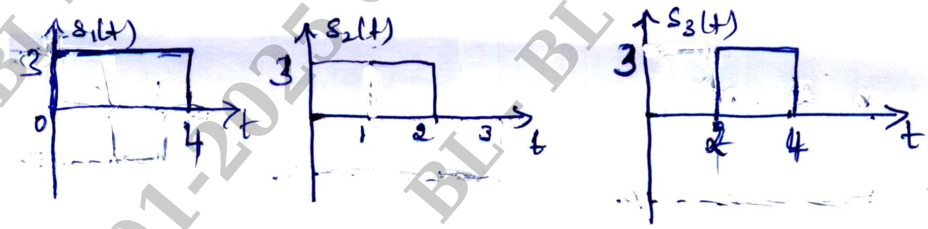


Fig.Q3(a) **(10 Marks)**

b. Explain the matched filter receiver with the relevant mathematical expressions. **(06 Marks)**

c. Explain how to convert continuous AWGN channel into a vector channel. **(04 Marks)**

OR

4 a. Explain the design of band limited signals with controlled ISI, describe the Time domain and frequency domain characteristics of a duo-binary signal. **(08 Marks)**

b. The binary sequence 111010010001101 is the input to the precoder whose output is used to modulate a duo binary transmitter filter. Obtain the precoded sequence, transmitted amplitude levels, the received signal level and the decoded sequence. **(08 Marks)**

c. State Nyquist criteria. **(04 Marks)**

Module-3

5 a. Explain the generation of direct sequence spread spectrum with relevant waveform and spectrum. **(08 Marks)**

b. Explain any three applications of DSSS. **(06 Marks)**

c. List and explain the properties of PN sequence. **(06 Marks)**

OR

6 a. With a neat block diagram, explain the frequency hopped spread spectrum. **(08 Marks)**

b. Draw a 3-stage LFSR, with first and 3rd stage connected to a modulo 2 adder and the output sequence is given by the 3rd stage. Consider 110 as the initial state. **(08 Marks)**

c. The spread spectrum communication system has the following parameters, $T_b = 1.024$ msec, PN chip duration of 1 μsec. The average probability of error of system is not to exceed 10^{-5}. Calculate length of shift register, processing gain and Jamming margin. **(04 Marks)**

Module-4

7 a. A code is composed of dots and dashes. Assuming that a dash is 3 times as long as a dot and has 1/3 the probability of occurance, calculate:
(i) The information in a dot and a dash
(ii) Entropy of dot dash code
(iii) Average rate of information, if a dot lasts for 10 msec and this time is allowed between symbols. **(08 Marks)**

b. Given the message x_1, x_2, x_3, x_4, x_5 and x_6 with respective probabilities 0.4, 0.2, 0.2, 0.1, 0.07 and 0.03. Construct a binary code by applying Shannon's fano encoding procedure and determine the code efficiency and redundancy. **(08 Marks)**

c. Define the following with respect to information theory:
(i) Self information (ii) Rate of information **(04 Marks)**

OR

8 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
$\frac{1}{8}$	$\frac{1}{16}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{3}{8}$

(08 Marks)

b. Given the messages s_1, s_2, s_3 and s_4 with respective probabilities of 0.4, 0.3, 0.2 and 0.1. Construct a binary code by applying Huffman encoding procedure determine code efficiency and redundancy of the code. **(08 Marks)**

c. List and explain the error control codes. **(04 Marks)**

Module-5

9 a. Consider a (6, 3) linear code where generator matrix is :

$$h = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

(i) Find all code vector.
(ii) Find all the hamming weight and distances.
(iii) Find min weight parity check matrix.
(iv) Draw the encoder circuit for the above codes. **(10 Marks)**

b. For a systematic (7, 4) linear block code, the parity matrix 'P' is given by

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

(i) Find all possible code vector.
(ii) Draw the corresponding encoding circuit.
(iii) A single error has occurred in each of these received vector, detect and correct those errors.

$R_A = [0111110]$ $R_B = [1011100]$ $R_C = [1010000]$ **(10 Marks)**

OR

10 a. For the convolution encoder shown in Fig.Q10(a), the information sequence is d = 10011. Find the o/p sequence using the following 2 approaches.
(i) Time domain approach
(ii) Frequency domain approach/transform domain approach

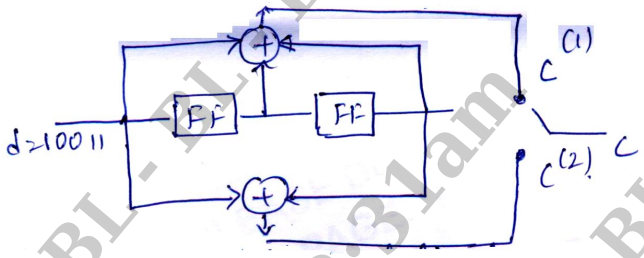


Fig.Q10(a) (2, 1, 2) convolutional encoder **(10 Marks)**

b. A gate 1/3 convolutional encoder has generating vectors $g_1 = 111$, $g_2 = 101$.
(i) Sketch the encoder configuration, write the transition table.
(ii) Draw the code tree and state diagram.
(iii) If input message sequence is 10111, determine the output sequence of the encoder using transform domain approach. **(10 Marks)**

* * * * *

CBCS SCHEME

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

21EC52

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
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.	Explain the pipelining and superscalar operation.	**(05 Marks)**
	b.	Briefly explain the different key parameters that affects the processor performance.	**(05 Marks)**
	c.	With a neat diagram, explain basic operational concept of computer.	**(10 Marks)**

OR

2	a.	Mention the difference between Big-endian and Little-endian assignments.	**(05 Marks)**
	b.	Explain the different types of addressing modes.	**(10 Marks)**
	c.	With diagram explain the Interrupt Hardware.	**(05 Marks)**

Module-2

3	a.	With diagram explain the internal organization of a 2M×8 dynamic memory chip.	**(10 Marks)**
	b.	Explain the operations of synchronous DRAM.	**(10 Marks)**

OR

4	a.	Explain the different types of memories.	**(10 Marks)**
	b.	With neat diagram explain the multiple bus organization.	**(10 Marks)**

Module-3

5	a.	Explain the architecture of ARM core dataflow model.	**(10 Marks)**
	b.	With neat diagram explain the ARM based embedded system.	**(10 Marks)**

OR

6	a.	Explain the ARM condition flag register.	**(05 Marks)**
	b.	What is pipeline? Explain the 3-stage ARM pipeline.	**(05 Marks)**
	c.	Explain the architecture of ARM processor.	**(10 Marks)**

Module-4

7	a.	With example explain the following instructions: i) ADC ii) EOR iii) SWI iv) UMULL v) SBC	**(10 Marks)**
	b.	With neat diagram explain the ARM stack operation.	**(10 Marks)**

OR

8	a.	Explain the ARM Registers and also explain each.	**(10 Marks)**
	b.	Explain the following ARMVSE extension instructions: i) CLZ ii) QADD iii) QSUB iv) SMLAxy v) QDADD	**(10 Marks)**

Module-5

9	a.	Explain the following THUMB instructions: i) TST ii) ROR iii) BX iv) BKPT v) ASR	**(10 Marks)**
	b.	Discuss the ARM support basic C data types.	**(10 Marks)**

OR

10	a.	Explain the ARM function calls and loop operations.	**(10 Marks)**
	b.	With example explain the single register and multiple register load store ARM instructions.	**(10 Marks)**

* * * * *

CBCS SCHEME

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

21EC53

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
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. Describe the layers of the TCP/IP protocol suite and explain the service provided by each layer with the help of a neat diagram. **(10 Marks)**

b. With neat diagrams, explain the working of ARP. Describe the structure and functions of various fields in the ARP packet. **(10 Marks)**

OR

2 a. With neat diagrams, explain the salient features, advantages and disadvantages of various physical topologies used in computer networks. **(12 Marks)**

b. Explain with neat diagrams, the concepts of encapsulation and decapsulation at various layers of the TCP/IP protocol suite, during communication between two hosts. **(08 Marks)**

Module-2

3 a. With clear examples, illustrate the following concepts and explain:
(i) Byte stuffing and unstuffing
(ii) Bit stuffing and unstuffing **(10 Marks)**

b. An ALOHA network transmits 200 bit frames on a shared channel of 200 kbps. Calculate the throughput of the system if it produces 1000 frames per second in case of:
(i) Pure ALOHA (ii) SLOTTED ALOHA **(06 Marks)**

c. Explain the Ethernet Frame Format with a neat diagram. **(04 Marks)**

OR

4 a. With relevant flow diagrams, explain 1-persistent, non-persistent and p-persistent methods in CSMA. **(10 Marks)**

b. Explain the working of CSMA/CA protocol with a neat flow diagram. Describe how CSMA/CA overcomes the problems of collision during handshaking and hidden stations. **(10 Marks)**

Module-3

5 a. Explain virtual circuit approach used in packet switching. With neat diagrams and an example, illustrate the 3 stages of virtual circuit approach. **(10 Marks)**

b. With a neat diagram, explain the IPv4 datagram. **(10 Marks)**

OR

6 a. Explain distance vector routing algorithm, using Bellman-Ford equations. Illustrate the same with an example. **(10 Marks)**

b. Describe how the IPV4 address space is occupied in classful addressing. **(04 Marks)**

c. An organization is granted a block of addresses with the beginning address 14.24.74.0/24. The organization needs to have 3 subblocks of addresses to use in its 3 subnets: one subblock of 10, one subblock of 60, and one subblock of 120 addresses. Design the subblocks. **(06 Marks)**

Module-4

7 a. Describe the connectionless and connection-oriented services provide by the transport layer in TCP/IP. **(10 Marks)**

b. With a neat diagram, explain the TCP segment format, including the pseudoheader. **(10 Marks)**

OR

8 a. Explain the selective repeat protocol with neat diagrams and illustrate with an example. **(10 Marks)**

b. The content of a UDP header format is given as CB84000D001C001C. Determine the following:
   (i) The source port number
   (ii) The destination port number
   (iii) Total length of the user datagram
   (iv) Length of the data
   (v) Is the packet directed from client to server or vice-verse? **(05 Marks)**

c. Explain Checksum calculation in UDP using pseudoheader. **(05 Marks)**

Module-5

9 a. Explain the architecture of Electronic Mail, with a neat diagram. **(10 Marks)**

b. Explain persistent and non-persistent connections in HTTP, with example. **(10 Marks)**

OR

10 a. With a neat taxonomy, describe various security attacks in communication networks. **(08 Marks)**

b. With neat diagrams, explain the following with respect to DNS:
   (i) Name space
   (ii) DNS in the internet
   (iii) Name Address Resolution **(12 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | **21EC54**

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
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. If two position vectors $\overline{A} = -2\overline{a}_x - 5\overline{a}_y - 4\overline{a}_z$ and $\overline{B} = 2\overline{a}_x + 3\overline{a}_y + 5\overline{a}_z$ then find,
i) $\overline{AB}$ ii) $\overline{a}_A, \overline{a}_B$ iii) $\overline{a}_{AB}$ iv) Unit vector from C to A where C is (3, 5, 8) **(06 Marks)**

b. Ten identical charges each of 500 μc are spaced equally around a circle of radius 2 m. Find the force on a charge of – 20 μc located on the axis, 2m from the plane of the circle. **(07 Marks)**

c. Define Electric Field Intensity. Derive expression for electric field intensity due to 'n' number of charges. **(06 Marks)**

OR

2 a. Given the two points A(2, 3, –1) and B(4, 25, 120). Find spherical coordinates of A and Cartesian coordinates of B. **(06 Marks)**

b. Derive an expression for electric field intensity due to infinite line charge. **(07 Marks)**

c. Find electric field $\overline{E}$ at origin, if the following charge distribution are present in free space :
i) Point charge of 21nc at P(2, 0, 6)
ii) Uniform line charge of infinite length with charge density $\rho_\ell = 3$ nC/m at x = 2, y = 3.
iii) Uniform surface charge of density 0.2 nC/m^2 at x = 2. **(07 Marks)**

Module-2

3 a. A charge is uniformly distributed over a spherical surface of radius 'a'. Determine electric field intensity at all the places, use Gauss law. **(07 Marks)**

b. Evaluate both sides of divergence theorem for the field $\overline{D} = 2xy\,\overline{a}_x + x^2\,\overline{a}_y$ C/m^2, for a rectangular parallel piped formed by the planes x = 0 and x = 1 ; y = 0 and y = 2 ; z = 0 and z = 3. **(08 Marks)**

c. Show that electric field intensity is negative potential gradient. **(05 Marks)**

OR

4 a. The flux density $\overline{D} = \frac{r}{3}\overline{a}_r$ nC/m^2 in free space :
i) Find $\overline{E}$ at r = 0.2 m
ii) Find the total electric flux leaving the sphere of r = 0.2 m.
iii) Find the total charge within the sphere of r = 0.3 m **(07 Marks)**

b. State and prove Gauss divergence theorem. **(07 Marks)**

c. Derive an expression for continuously equation. **(06 Marks)**

Module-3

5 a. Determine whether or not the following potential fields satisfy the Laplace's equation:
i) $V = x^2 - y^2 + z^2$ ii) $V = r\cos\phi + z$ iii) $V = r\cos\theta + \phi$ **(06 Marks)**

b. Evaluate both sides of Stoke's theorem for the field $\overline{H} = 6xy\bar{a}_x - 3y^2 a_y$ A/m, for rectangular path around the region, $2 \le x \le 5$, $-1 \le y \le 1$, $z = 0$. **(08 Marks)**

c. Explain the concept of magnetic potential. **(06 Marks)**

OR

6 a. State and prove uniqueness theorem. **(06 Marks)**

b. Two plates of parallel plate capacitor are separated by distance 'd' and maintained at potential zero and V_0 respectively. Determine,
i) Potential at any position between the plates
ii) Surface charge density on the plates
iii) Capacitance between the plates. **(08 Marks)**

c. Find the magnetic flux density at the centre 'O' of a square of sides equal to 5 m and carrying 10 A of current. **(06 Marks)**

Module-4

7 a. Derive an expression for force on a differential current element and find force experienced by conductor of 6 m long, lies along z-direction with a current of 2A in $\bar{a}_z$ direction, if $\overline{B} = 0.08\bar{a}_x T$. **(07 Marks)**

b. Explain magnetization and permeability. **(07 Marks)**

c. Derive boundary conditions at the interface of two magnetic materials. **(06 Marks)**

OR

8 a. A point charge of $Q = -1.2C$ has velocity $\bar{\upsilon} = (5\bar{a}_x + 2\bar{a}_y - 3\bar{a}_z)$ m/s. Find the magnitude of force exerted on the charge if,
i) $\overline{E} = -18\bar{a}_x + 5\bar{a}_y - 10\bar{a}_z$ V/m
ii) $\overline{B} = -4\bar{a}_x + 4\bar{a}_y + 3\bar{a}_z$ T
iii) Both are present simultaneously. **(07 Marks)**

b. Find the magnetization in a magnetic material where:
i) $\mu = 1.8\times10^5$ H/m and M = 120 A/m
ii) $\mu = 22$, there are 8.3×10^{28} atoms/m^3 each atom has a dipole moment of 4.5×10^{-27} A/m^2 and
iii) B = 300 μT and $X_m = 15$ **(07 Marks)**

c. State and explain Faraday's law of electromagnetic induction. Hence obtain Maxwell's equation in point form and integral form. **(06 Marks)**

Module-5

9 a. Derive Maxwell's equations for time varying fields, represent them in point form and integral form. **(08 Marks)**

b. Obtain relationship between $\overline{E}$ and $\overline{H}$ in free space. **(06 Marks)**

c. In free space $\bar{E} = 50\cos(\omega t - \beta z)\bar{a}_x$ V/m. Find the average power crossing a circular area of radius 2.5m in the plane $z = 0$. **(06 Marks)**

OR

10 a. Given $\bar{E} = E_m \sin(\omega t - \beta z)\bar{a}_y$ in free space, find $\bar{D}$, $\bar{B}$ and $\bar{H}$. Sketch $\bar{E}$ and $\bar{H}$ at $t = 0$. **(08 Marks)**

b. Explain wave propagation in good conductor with relevant equations. **(08 Marks)**

c. Wet marshy soil is characterized by $\sigma = 10^{-2}$ s/m, $\varepsilon_r = 15$ and $\mu_r = 1$. At 1 MHz whether soil be considered as conductor or dielectric. **(04 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

BEC501

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Technological Innovation and Management Entrepreneurship

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 different roles played by Managers.	10	L1	CO1
	b.	Describe the managerial skills required using skill-mix diagram.	10	L1	CO1
		OR			
Q.2	a.	Explain the various steps involved in planning.	10	L2	CO1
	b.	Explain all the steps in rational decision making with a neat diagram.	10	L2	CO1
		Module – 2			
Q.3	a.	Define organization. Briefly explain the principles of organizing.	10	L2	CO2
	b.	What is recruitment? Explain the steps in the selection process.	10	L2	CO2
		OR			
Q.4	a.	Explain Maslow's need hierarchy theory with a neat diagram along with examples.	10	L2	CO2
	b.	Discuss Autocratic, Democratic and Free-rein leadership styles.	10	L2	CO2
		Module – 3			
Q.5	a.	Define Social Audit. Explain the benefits and limitations of social audit.	10	L2	CO3
	b.	Explain the different views on social responsibility of business.	10	L2	CO3
		OR			
Q.6	a.	Explain different types of entrepreneurs by defining an entrepreneur.	10	L2	CO3
	b.	Explain entrepreneurial development cycle.	10	L2	CO3
		Module – 4			
Q.7	a.	Explain the different Government policy and development of the small scale sector in India.	10	L2	CO4
	b.	Explain the problems for small scale industries.	10	L2	CO4
		OR			
Q.8	a.	Explain the identification of business opportunities in India.	10	L2	CO4
	b.	Explain in detail the project feasibilities.	10	L2	CO4
		Module – 5			
Q.9	a.	What are the reasons for failure of some business plans?	10	L2	CO4
	b.	Explain the Government schemes for funding business.	10	L2	CO4
		OR			
Q.10	a.	Explain the challenges and difficulties in starting an enterprise.	10	L2	CO4
	b.	Describe the limitations and differences of PERT and CPM.	10	L2	CO4

* * * * *

CBCS SCHEME

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

BEC502

Fifth Semester B.E/B.Tech. Degree Examination, Dec.2024/Jan.2025
Digital Signal Processing

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
1	a.	List and discuss different discrete time signals.	7	L2	CO1
	b.	Explain the steps of converting along to digital signal interms of frequencies.	7	L2	CO1
	c.	Discuss the advantages and limitations of Digital Signal Processing (DSP).	6	L2	CO1
		OR			
2	a.	With an example, explain how to verify any signal is periodic or Not.	6	L2	CO1
	b.	Derive the equation for output of a LTI system and list the steps of convolution.	8	L3	CO2
	c.	Write a program to generate : i) Circuit step sequence ii) Sinusoidal sequence.	6	L3	CO2
		Module – 2			
3	a.	Describe the properties of Z – transformation.	7	L3	CO2
	b.	Show that Discrete Fourier Transform (DFT) is a Liner Transformation.	7	L3	CO2
	c.	Compute the A-point DFT of $x(n) = \{1, 1, 0, 0\}$.	6	L3	CO2
		OR			
4	a.	Compute the N-point DFT of, $x(n) = e^{j\omega mn}$.	6	L3	CO2
	b.	State and prove symmetry property of DFT for real valued sequence.	6	L3	CO2
	c.	Compute circular convolution of sequences : $x_1(n) = \{2, 1, 2, 1\}$ and $x_2(n) = \{1, 2, 3, 4\}$.	8	L3	CO2
		Module – 3			
5	a.	State and prove circular item shift property of DFT.	6	L3	CO2
	b.	Compare DFT and FFT with examples.	6	L2	CO3
	c.	Compute Radix – 2 DIT FFT of the following – sequence, $x(n) = n + 1$, for $0 \le n \le 7$.	8	L3	CO3
		OR			
6	a.	State and prove Parseval's theorem for – DFT's.	6	L3	CO2
	b.	Explain overlap – save method used for the convolution of long input sequences.	6	L2	CO3
	c.	Develop an algorithm for Radix – 2 FFT without using built in function.	8	L3	CO3

		Module – 4			
7	a.	Obtain the frequency response expression for the symmetric linear phase FIR filter.	**8**	**L3**	**CO4**
	b.	Compare different widows used to design FIR filters.	**6**	**L2**	**CO4**
	c.	Design an FIR filter using hamming window for N = 7. The desired frequency response is given by $H_d(\omega) = \begin{cases} e^{-j3\omega} & \lvert\omega\rvert \le \frac{3\pi}{4} \\ 0, & \frac{3\pi}{4} < \lvert\omega\rvert \pi \end{cases}$.	**6**	**L3**	**CO4**
		OR			
8	a.	Discuss the characteristics of practical frequency selective filters.	**6**	**L3**	**CO4**
	b.	Explain the steps of designing linear phase FIR high pass filter.	**8**	**L2**	**CO4**
	c.	Realize the system function of following FIR filter in cascade form. $H(z) = 1 - 2z^{-1} + \frac{1}{2}z^{-2} + \frac{1}{2}z^{-3} - \frac{1}{2}z^{-4}$.	**6**	**L3**	**CO4**
		Module – 5			
9	a.	Explain the design procedure of analog Butter worth lowpass prototype – filter?	**8**	**L3**	**CO5**
	b.	Construct the system function in S – domain for N = A.	**6**	**L3**	**CO5**
	c.	Realize direct form – II for the IIR filter represented by $y(n) - \frac{1}{4}y(n-1) + \frac{1}{8}y(x-2) = x(n) + \frac{1}{2}x(n-2)$.	**6**	**L3**	**CO5**
		OR			
10	a.	Design the digital IIR filter for following details. –3dB gain at 0.5π rads and the stop band automation of 15dB at 0.75π rads. Assume T_s = 15.	**8**	**L3**	**CO5**
	b.	Explain the significance of : i) Prewarping ii) Bilinear transformation.	**6**	**L2**	**CO5**
	c.	Obtain the direct form-I realization of following IIR filter : $H(z) = \frac{1 + 0.4z^{-1}}{1 - 0.5z^{-1} + 0.06z^{-2}}$.	**6**	**L3**	**CO5**

* * * * *

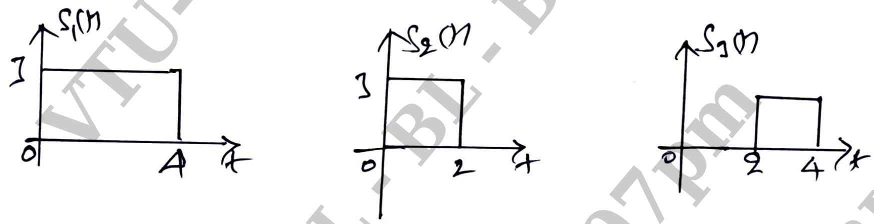
CBCS SCHEME

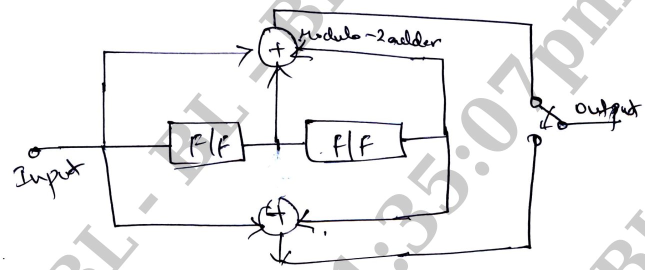
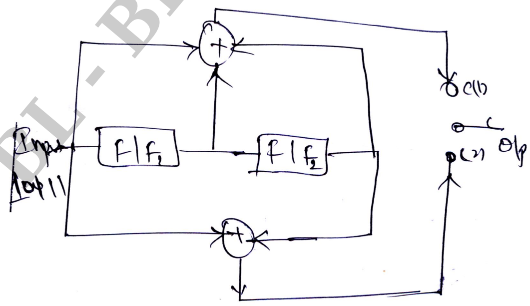
USN | | | | | | | | | | | **BEC503**

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Digital Communication

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 Hilbert transform and its properties.	6	L2	CO1
	b.	Describe the canonical representation of bandpass signal.	7	L2	CO1
	c.	Describe the correlation receiver with neat diagram.	7	L2	CO1
		OR			
Q.2	a.	Apply gram Schmidt orthogonalizaiton 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.Q2(a). Also express each of these figures interms of set of basis function.  Fig.Q2(a)	10	L3	CO1
	b.	Derive the equation for converting continuous AWGN channel into a vector channel.	10	L2	CO1
		Module – 2			
Q.3	a.	Describe with a neat diagram, the generation and detection of BPSK signal.	8	L2	CO2
	b.	Define bandwidth efficiency. Tabulate the comment on the bandwidth efficiency of M-ary PSK signal.	8	L2	CO2
	c.	Encode the binary sequence using DPSK 11011011. Assume reference bit as 1.	4	L2	CO2
		OR			
Q.4	a.	Derive the expression for probability of error of QPSK signal.	8	L2	CO2
	b.	Discuss the non-coherent detection of BFSK signal.	8	L2	CO2
	c.	Calculate the average power required for a DPSK signal operation gat a data rate of 1000 bit/sec, over a band-pass channel having a bandwidth of 3000 Hz, $\frac{N_0}{2} = 10^{-10}\, w/H_z$ probability of error $P_e = 10^{-5}$.	4	L3	CO2
		Module – 3			
Q.5	a.	Define entropy and summaries its properties.	6	L2	CO3
	b.	A source has five symbols S = {S_1. S_2, S_3, S_4, S_5} with probabilities P = {0.4, 0.2, 0.2, 0.1, 0.1} respectively. compute the source code using Huffman binary coding. Also find the average length and entropy.	8	L3	CO3
	c.	Briefly discuss instantaneous code with an example.	6	L2	CO3
		OR			
Q.6	a.	Derive the expression for mutual information and summarize its properties.	10	L2	CO3
	b.	Derive the expression for the channel capacity of binary symmetric channel.	10	L3	CO3

		Module – 4			
Q.7	**a.**	Indicate the advantages and disadvantages of error control coding. Also differentiate between block code and convolution code.	**8**	**L2**	**CO4**
	b.	If 'C' is a valid code vector then show that $CH^T = 0$ where H is parity check matrix of code.	**5**	**L2**	**CO4**
	c.	Design an encoder for the (7, 4) binary cyclic code generated by : $g(x) = 1 + x + x^3$ for the message vector [1001].	**7**	**L3**	**CO4**
		OR			
Q.8	**a.**	Describe the block diagram of generator and parity check matrix with equation. Also write the syndrome equation and list its properties.	**10**	**L2**	**CO4**
	b.	A (7, 4) Linear block code has : $P = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$ i) All possible code vector ii) Determine the Hamming weight of each code word iii) If the received vector is [1100010]. Determine its syndrome correct the codeword.	**10**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	For a given convolutional encoder shown in Fig.Q9(a), with D = 10011. Compute output sequence using transform domain approach. Also draw the code free diagram.  Fig.Q9(a)	**10**	**L3**	**CO5**
	b.	Describe the recursive systematic convolutional code encoder with an example.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	A convolution encoder has two flip-flop with two states, three modulo – 2 adders and an output multiplexer. The generator sequences of the encoder. $g^{(1)} = (1, 0, 1)$, $g^{(2)} = (1, 1, 0)$, $g^{(3)} = (1, 1, 1)$. i) Generator matrix [G] ii) Draw the encoder block diagram iii) Calculate the codeword for the message input vector 11101.	**10**	**L3**	**CO5**
	b.	For a given convolution encoder shown in Fig.Q10(b). Build state table, state transaction table, sketch diagram and describe the Trellis diagram for the input message vector (10111).  Fig.Q10(b)	**10**	**L3**	**CO5**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

BEC515D

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Satellite and Optical Communication

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 Keplar laus of planetary motion. Also derive the expression for orbital period.	10	L2	CO1
	b.	A satellite is orbiting earth in a uniform circular orbit at a height of 630 kM from the surface of earth. Assuming the radius of earth and its mass to be 6370 kM and 5.98×10^{24} kg respectively. Determine the velocity of the satellite. (Take gravitational const $G = 6.67 \times 10^{-11}$ Nm^2/kg^2).	10	L3	CO1
		OR			
Q.2	a.	The apogee and perigee distance of satellite arbiting in an elliptical orbit are respectively, 45000 km and 7000 km. Determine the followings: i) Semi-major axis of the elliptical orbit. ii) Orbit eccentiricity iii) Distance between the center of earth and the center of elliptical orbit.	10	L3	CO1
	b.	Explain briefly any six orbital parameters required to determine a satellite orbit.	10	L2	CO1
		Module – 2			
Q.3	a.	Explain the satellite subsystems.	10	L2	CO2
	b.	Explain the solar energy driven power supply system of a satellite.	10	L2	CO2
		OR			
Q.4	a.	Describe the telemetry, telecommand and tracking control monitoring system of a communication satellite.	10	L2	CO2
	b.	Explain with block schematic arrangement of a generalized earth's station.	10	L2	CO2
		Module – 3			
Q.5	a.	What is transponder? Explain the various types of transponders.	10	L2	CO3
	b.	List the advantages and disadvantages of satellites with respect to terrestrial networks.	10	L1	CO3
		OR			
Q.6	a.	Explain with a neat diagram satellite point-to-point telephonic network.	10	L2	CO3
	b.	Explain with a neat diagram satellite – cable TV.	10	L2	CO3

		Module – 4			
Q.7	**a.**	Explain the mode theory as applied to circular wavelength (wave guides) in optical fibers.	**10**	**L2**	**CO4**
	b.	Describe the operational difference between single-mode and multimode fibers in terms of bandwidth and attenuation.	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	What is modal delay and how does it contribute to modal dispersion in multimode fibers?	**10**	**L2**	**CO4**
	b.	Define material dispersion and explain how it arises in optical fibers.	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Explain the principle operation of LED's.	**10**	**L2**	**CO5**
	b.	Discuss the characteristics of the optical detectors.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Explain the principle operation of WDM standards.	**12**	**L2**	**CO5**
	b.	Explain the isolators and circulators.	**8**	**L2**	**CO5**

* * * * *

CBCS SCHEME

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

18EC61

Sixth Semester B.E. Degree Examination, Dec.2024/Jan.2025
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. Define Hilbert transform. What are the applications of Hilbert transform? Prove that a signal g(t) and its Hilbert transform $\hat{g}(t)$ are orthogonal over the entire time interval $(-\infty, \infty)$. **(10 Marks)**

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

OR

2 a. Express bandpass signal s(t) in canonical form. Also explain the scheme for deriving the inphase and quadrature components of the bandpass signal s(t). **(10 Marks)**

b. For a binary sequence 0100000001011 construct:
(i) RZ bipolar format (ii) Manchester format (iii) B3ZS format
(iv) B6ZS format (v) HDB3 format **(10 Marks)**

Module-2

3 a. Explain the geometric representation of set of M energy signals as linear combination of N orthonormal basis functions. Illustrate for the case N = 2 and M = 3 with necessary diagrams and expressions. **(10 Marks)**

b. Obtain the maximum likelihood decision rule for the signal detection problem. **(10 Marks)**

OR

4 a. Apply Gram-Schmidt procedure to obtain an orthonormal basis for the signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ as shown in Fig.Q4(a). Also express each of these signals interms of the set of basis functions.

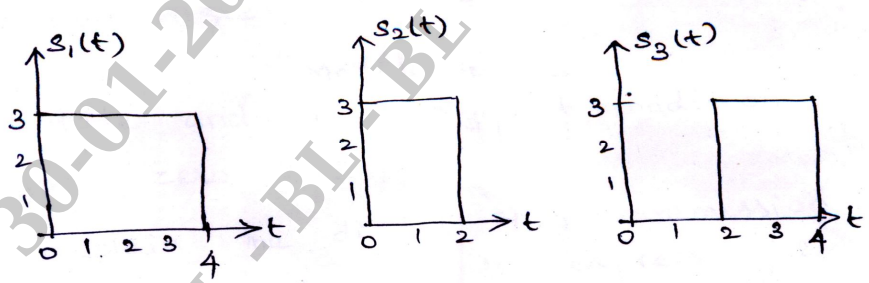


Fig.Q4(a) **(10 Marks)**

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

Module-3

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

b. With a neat block diagram, explain the generation and optimum detection of DPSK signals. **(10 Marks)**

OR

6 a. Using block diagram, explain the generation and detection of QPSK signal. **(10 Marks)**
b. Derive the expression for error probability of binary PSK using coherent detection. **(06 Marks)**
c. What is the advantage of M-ary QAM over M-ary PSK system? Obtain the constellation of QAM for M = 4 and draw signal space diagram. **(04 Marks)**

Module-4

7 a. State and prove Nyquist condition for zero ISI. **(08 Marks)**
b. Explain the digital PAM transmission system. Also derive the expression for Inter Symbol Interference (ISI). **(08 Marks)**
c. With neat diagram and relevant expression, explain the concept of adaptive equalization. **(04 Marks)**

OR

8 a. What is a zero forcing equalizer? With a neat block diagram, explain the operation of linear transversal filter. **(08 Marks)**
b. Explain the need for precoder in a duobinary signaling. The binary data 001101001 are applied to the input of a duobinary system. Construct the duo binary coder output and corresponding receiver output. Assume that precoder is used. **(08 Marks)**
c. Write a note on eye diagram. **(04 Marks)**

Module-5

9 a. Explain the model of a spread spectrum digital communication system. **(06 Marks)**
b. Illustrate the working of direct sequence spread spectrum transmitter and receiver with block diagram, waveforms and expressions. **(10 Marks)**
c. What is a PN sequence? What are the properties of maximum length sequences? **(04 Marks)**

OR

10 a. Explain frequency hop spread spectrum with neat block diagram. **(10 Marks)**
b. Illustrate the CDMA system forward link based on IS-95. **(10 Marks)**

* * * * *

CBCS SCHEME

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

18EC62

Sixth Semester B.E. Degree Examination, Dec.2024/Jan.2025
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. Describe the various units designed in the ARM Cortex M3 architecture, with a neat diagram. **(10 Marks)**

b. Explain the exceptions and IRQ interrupts of ARM Cortex M3 with a table and write the 2 timing diagrams when exception and interrupts are to be handled in privileged modes only, during the execution of a privileged or user thread. **(10 Marks)**

OR

2 a. Describe the general purpose Registers, R_{13} – R_{15}, special registers and PSR in detail, with the relevant diagrams for all. **(10 Marks)**

b. Explain the reset sequence and PUSH and POP instructions with examples, along with relevant diagrams for both. **(10 Marks)**

Module-2

3 a. Describe IF-THEN-ELSE, shift and rotate instructions (5 types) and logic operation instruction (4 types) with examples. **(11 Marks)**

b. Explain the following instruction with an example for each MLA, REV, STR, MSR. **(04 Marks)**

c. Develop an assembly level language program to add the decimal integer numbers 1 to 20. The result should be stored in register R_9, with counter as R_8. **(05 Marks)**

OR

4 a. Describe the ARM ALP/HLP development tools and the organization of CMSIS with diagrams. **(11 Marks)**

b. Explain the following instructions with an example for each: MRS, LDR, ADC, NEG. **(04 Marks)**

c. Develop a 'C' language program to switch ON or OFF a RED lamp with a delay program having a maximum count of 100 in decimal, for ARM cortex M3 processor. ON and OFF time should be equal. **(05 Marks)**

Module-3

5 a. Explain the four classifications of embedded system with features and examples based on the generations. **(04 Marks)**

b. Describe the elements of an embedded system with a block diagram. Also, explain any four types of ROMs. **(12 Marks)**

c. Differentiate between RISC and CISC architectures, with respect to their features in the design. **(04 Marks)**

OR

6 a. Explain any four purposes of embedded systems, with suitable examples for each. **(04 Marks)**
b. Describe optocoupler, DRAM and SPI with diagrams. **(12 Marks)**
c. Differentiate between embedded and general computing systems with respect to the design based on the applications. **(04 Marks)**

Module-4

7 a. Explain any four characteristics of embedded systems. **(04 Marks)**
b. Develop and explain the sequence of steps in the design of a Tea or Coffee vending machine, using FSM model only. **(08 Marks)**
c. Describe the embedded firmware design using ALP with its advantages and disadvantages, along with ALP to MLP conversion procedure. **(08 Marks)**

OR

8 a. Explain any four operational quality attributes in an embedded system design. **(04 Marks)**
b. Develop and explain the flow in the design of a seat belt warning system, with a sequential program model only. **(08 Marks)**
c. Describe the embedded firmware design using HLP, with its merits and demerits. How HLP is concreted to MLP in the design process? **(08 Marks)**

Module-5

9 a. Explain the function of a process with a state transition diagram, structure and memory organization of a process. **(08 Marks)**
b. Explain preemptive SJF scheduling with an example. **(06 Marks)**
c. Describe deadlock with the various conditions favouring deadlock situation. **(06 Marks)**

OR

10 a. Explain the various units in embedded system development environment with a diagram (IDE). **(08 Marks)**
b. Explain Round Robin scheduling technique with an example. **(06 Marks)**
c. Describe the functions of Real Time Kernel in RTOS, in brief. **(06 Marks)**

* * * * *

CBCS SCHEME

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

18EC63

Sixth Semester B.E. Degree Examination, June/July 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. With a neat diagram, explain construction and operation of reflex klystron. **(10 Marks)**

b. A line of $R_0 = 400\Omega$ is connected to a load of $200 + j300\Omega$ and is excited by a matched generator at 800MHz. Find the location and length of a single stub nearest to the load to produce an impedance match. **(10 Marks)**

OR

2 a. Derive transmission line equations in voltage and current forms. **(10 Marks)**

b. A telephone line has $R = 6\Omega$/km $L = 2.2$mh/km $C = 0.005\mu$F/km and $G = 0.05\ \mu$ mho/km. Determine z_0, α, β at 1 kHz. **(06 Marks)**

c. Define reflection coefficient and standing wave. **(04 Marks)**

Module-2

3 a. Explain the operation of a precision type variable attenuator with a neat sketch. **(10 Marks)**

b. Draw the diagram of magic tee and derive S-matrix of magic tee. **(10 Marks)**

OR

4 a. Draw the diagram of H-TEE and derive S-matrix for H-tee. **(08 Marks)**

b. A 20MN signal to fed into one of the collinear port 1 of a lossless H-plane T-junction. Calculate the power delivered through each port when other ports are terminated in matched load. **(04 Marks)**

c. For a two port network with mismatched load derive an expression for input reflection coefficient. **(08 Marks)**

Module-3

5 a. Define the following terms with respect to antenna:
   i) Beam area
   ii) Radiation intensity
   iii) Directivity
   iv) Beam efficiency
   v) Effective aperature. **(10 Marks)**

b. What are the losses in microstrip lines and briefly explain the same? **(10 Marks)**

OR

6 a. Obtain an expression for FRIS transmission formula used in radio communication link. **(08 Marks)**

b. A radio link has a 15W transmitter connected to an antenna of $2.5m^2$ effective aperature at 5GHz. The receiving antenna has an effective aperature of $0.5m^2$ and is located at a 15km line of sight distance from the transmitting antenna. Assuming lossless matched antennas find the power delivered to the receiver. **(06 Marks)**

c. A source has a radiation intensity pattern given by $U = U_m \sin\theta$. The radiation intensity 'U' has a value only in the upper hemisphere ($0 \le \theta \le x$) and ($\theta \le \phi \le 2x$). Find total power radiated by the source and directivity. **(06 Marks)**

Module-4

7 a. State and explain the power theorem. **(08 Marks)**

b. Derive an expression for total field in case of two isotropic point sources of same amplitude and phase. Plot the relative field pattern when these two isotropic sources are spaced $\lambda/2$ apart. **(12 Marks)**

OR

8 a. Derive an expression for total field for linear array of n isotropic point sources of equal amplitude and spacing. **(10 Marks)**

b. Derive the expression for the radiation resistance of short dipole. **(10 Marks)**

Module-5

9 a. Obtain the expression for radiation resistance of small loop antenna. **(10 Marks)**

b. With a neat diagram, explain the operation of log 'periodic antenna'. **(10 Marks)**

OR

10 a. Discuss the following antenna types:

i) Helical antenna

ii) Yagi uda antenna. **(10 Marks)**

b. Explain rectangular horn antenna with a neat diagram. **(10 Marks)**

* * * * *

CBCS SCHEME

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

18EC644

Sixth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Digital System Design using Verilog

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain design methodology followed in IC industry with neat sketch. **(10 Marks)**

b. Develop a verilog model for a 7-segment decoder. Include an additional input, blank, that overrides the BCD input and causes all segments not to be lit. **(05 Marks)**

c. Develop a verilog model of a debouncer for a push-button switch that uses a debounder interval of 10 ms. Assume the system clock frequency is 50 MHz. **(05 Marks)**

OR

2 a. Explain the following constraints imposed in real world circuits:
(i) Noise margin (ii) Static levels (iii) Propagation delay
(iv) Static and dynamic power consumption. **(08 Marks)**

b. Develop a verilog model of a 4-to-1 multiplexer that selects among four unsigned 6-bit integers. **(04 Marks)**

c. Develop a datapath to perform a complex multiplication of two complex numbers. The operands and product are all in Cartesian form. The real and imaginary parts of the operands are represented as signed fixed point numbers with 4 pre-binary point and 12 post-binary-point bits. The real and imaginary parts of the product are similarly represented, but with 8-pre-binary point and 24 post-binary point bits. Area is the main constraint. **(08 Marks)**

Module-2

3 a. Determine whether there is an error in the ECC word 000111000100, and if so, correct it. **(05 Marks)**

b. Develop and explain a verilog model of a dual port 4K×16 - bit flow through SSRAM. One port allows data to be written and read, while the other port only allows data to be read. **(05 Marks)**

c. Develop a 64K×8 - bit composite memory using four 16K×8 - bit components and also explain how memory components with tristate data outputs simplify the construction of larger memories. **(10 Marks)**

OR

4 a. What is the difference between asynchronous static RAM and synchronous static RAM? **(06 Marks)**

b. Design a FIFO to store upto 256 data items of 16 bits each, using a 256×16 bit dual port SSRAM for the data storage. The FIFO should provide status outputs, to indicate when the FIFO is empty and full. Assume that the FIFO will not be read when it is empty, not be written to when it is full, and that the write and read ports share a common clock. **(08 Marks)**

c. Write a symbol for basic memory component and explain its parts. **(06 Marks)**

Module-3

5 a. Explain with a neat diagram of the internal organization of a CPLD. **(06 Marks)**

b. Explain briefly bout the sequence of steps involved in IC manufacture. **(08 Marks)**

c. Distinguish between a platform FPGA from a simple FPGA? **(06 Marks)**

OR

6 a. Design 4-digit decimal counter with seven segment LED display with neat sketch using two 74LS390 dual decade counter, four 74LS47 BCD to seven segment decoder, four 7-segment display, plus any additional gates required. **(10 Marks)**

b. Explain different types of PCB design. **(05 Marks)**

c. Explain the differential signaling. **(05 Marks)**

Module-4

7 a. Explain any four serial interface standards. **(08 Marks)**

b. Show how 64-bit data word can be transmitted serially between two ports of a system. Assume that the transmitter and the receiver are both within the same clock domain and that the signal start is set to 1 on a clock cycle in which data is ready to be transmitted. **(07 Marks)**

c. Explain neatly the designing of R-string DAC. **(05 Marks)**

OR

8 a. Design an develop the verilog code for an input controller that has 8-bit binary coded input from a sensor. The value can be read from an 8-bit input register. The controller should interrupt the embedded Gumnut core when the input value changes. The controller is the only interrupt source in the system. **(08 Marks)**

b. Explain the analog inputs used in input devices. **(04 Marks)**

c. Explain the concept of multiplexed buses. **(08 Marks)**

Module-5

9 a. Explain the design flow of hardware/software co-design. **(10 Marks)**

b. Explain the design optimization that are must to meet the design constraints. **(10 Marks)**

OR

10 a. Explain 4-bit LFST and CFSR for generating pseudorandom test vectors. **(10 Marks)**

b. Explain logical partitioning and physical partitioning of a transport monitoring system. **(10 Marks)**

* * * * *

CBCS SCHEME

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

18EC646

Sixth Semester B.E. Degree Examination, Dec.2024/Jan.2025
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. Explain the concept of type conversion functions, math functions, Fruitful and void factions in python with examples. **(10 Marks)**

b. Predict the output and justify your answer for the following operations
i) 11%9 ii) 7.7//7 iii) (200 – 70)*10/5 iv) not 'False' v) 5*2**2. **(10 Marks)**

OR

2 a. Write a program to prompt for a score between 0.0 and 1.0. If the score is out of range, print an error message. If score is between 0.0 and 1.0, print a grade using the following table :
> = 0.9 : A
> = 0.8 : B
> = 0.7 : C
> = 0.6 : D
> = 0.6 : F **(10 Marks)**

b. Differentiate complier and interpreter. **(06 Marks)**

c. List the building blocks of program and explain each them. **(04 Marks)**

Module-2

3 a. List any five string methods of python and explain each of them with an example. **(10 Marks)**

b. Predict the output and justify your answer for the following python program.

```
def fun (a, b, c) :
Z = [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
for i in range (len (a)) :
z[i] = C* a[i] + b
return (z)
d = 2
e = [2, 5, 6, 8, 10, 15, 4, 3, 1,9]
f = 3
y = fun (e, d, f)
print ('y=' y)
print ('Extract='y[ℓen(e) – 3 :])
```

(10 Marks)

OR

4 a. Write a program which repeatedly reads numbers until user enters "done". Once "done" is entered, print out the total, count and average of the numbers. If the user enters anything other than a number, detect their mistake using try and except and print an error message and skip to the next number. **(10 Marks)**

b. List python functions used for file handling and explain each of them with examples. **(10 Marks)**

Module-3

5 a. For a given list T which contains the alphabets from 'a' to 'j', write a function called chop that takes a list T and modifies it, removing the first and last elements, and return None. Then write a function called middle that takes a list T and returns a new list that contains all excluding the first and last elements. Finally call these two function in the main program and print the return values. **(07 Marks)**

b. What is a list? Explain the concept of list slicing and list traversing with examples. **(06 Marks)**

c. Write a python program to read the string build a histogram using a dictionary to count occurrence of characters in a string and print the dictionary. **(07 Marks)**

OR

6 a. Applying the concept of Dictionaries and Tuples, write a python program which reads the file and computers the count of words present in the file and print the ten most common words in the file. **(10 Marks)**

b. Applying the concept of regular expression write a python program to search for lines that start with 'F' followed by 2 characters, followed by 'm:' and search for lines that having '@' sign between characters, the characters must be letter or number. **(10 Marks)**

Module-4

7 a. What is a Class? How to define a class in python? How to instantiate a class and how the class members are accessed? **(10 Marks)**

b. Write a definition for class named circle with attributes center and radius, where center is point object and radius is a number. Instantiate a circle object that represent a circle with its center at (150, 100) and radius 75. Write a function named point – in – circle that takes a circle and a point and returns true if the point lies in or on boundary of the circle. **(10 Marks)**

OR

8 a. Show using a python code how_ init_ method is involved when an object is initiated. Explain its working. **(10 Marks)**

b. What is types based dispatch? Write an add method for Time that works with either a Time object or an integer value. If the second operand is a Time, the method should invoke the add-time function to add the time value, if the second operand is a integer value the method should invoke the increment function to increment time by integer value and print the corresponding output. **(10 Marks)**

Module-5

9 a. Demonstrate with the help of python construct how to retrieve an image over HTTP and web pages with urllib. **(10 Marks)**

b. Brief on structured query language, with suitable python program, explain functions involved in creation of database table in python. **(10 Marks)**

OR

10 a. Illustrate the concept of parsing JSON and parsing XML with python code. **(08 Marks)**

b. Compare and contrast the JavaScript Object Notation (JSON) and XML. **(04 Marks)**

c. Explain with python code, the concept of using JOIN to retrieve data in python. **(08 Marks)**

CBCS SCHEME

USN | | | | | | | | | | **18EC655**

Sixth Semester B.E. Degree Examination, June/July 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. Illustrate CMOS P well process step by step with neat diagram. **(10 Marks)**

b. Derive the expression for MOS transistor transconductance g_m and output conductance g_{ds}. **(10 Marks)**

OR

2 a. Write the comparison between CMOS and bipolar technologies. **(10 Marks)**

b. Derive the expression for current (I_{ds}) equation of nmos transistor in following region :
(i) Non saturated region.
(ii) Saturated region. **(10 Marks)**

Module-2

3 a. Discuss Latch-up in CMOS circuits with its circuit model. Also highlight the remedies for latch-up problem. **(10 Marks)**

b. Describe formal estimation of CMOS Inverter delay using rise time and fall time model. **(10 Marks)**

OR

4 a. Determine PULL-UP to PULL-DOWN ratio for an nMOS inverter driven through one or more Pass transistor. **(10 Marks)**

b. Define sheet resistance (R_S). Illustrate how to calculate sheet resistance with suitable example. **(04 Marks)**

c. Calculate the area capacitance for the below Fig. Q4 (c). **(06 Marks)**

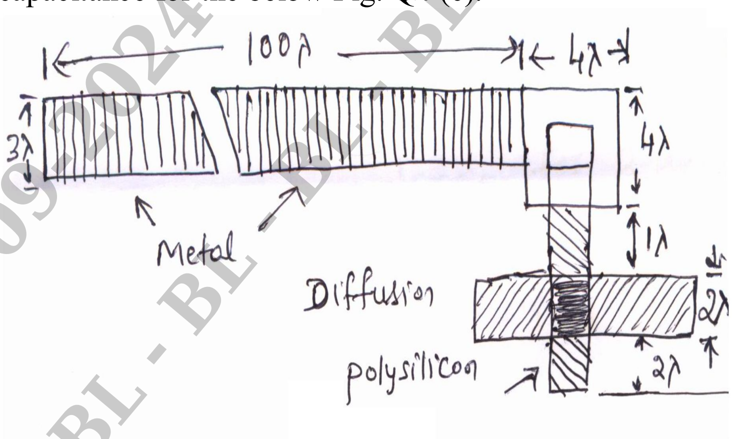


Fig. Q4 (c)

Module-3

5 a. Draw the stick diagram, for the function $\overline{X} = A + BC$ **(08 Marks)**
b. Illustrate CMOS design style with a diagram. **(08 Marks)**
c. Derive the scaling factor for,
(i) Gate area
(ii) Gate capacitance
(iii) Channel resistance
(iv) Parasitic capacitance **(04 Marks)**

OR

6 a. Discuss Lambda based design rules. **(08 Marks)**
b. Draw the stick diagram, for 2-input NOR gate using NMOS and CMOS type. **(08 Marks)**
c. Derive the scaling factor for,
(i) Gate delay
(ii) Current density
(iii) Operating frequency
(iv) Switching energy per gate. **(04 Marks)**

Module-4

7 a. Draw the pseudo-nMOS NAND gate and explain the same. **(06 Marks)**
b. Explain structural design approach for parity generator an draw its stick diagram using NMOS design style. **(08 Marks)**
c. Draw the stick-diagram for bus arbitration logic. **(06 Marks)**

OR

8 a. Draw the stick diagram for 3-input NAND gate using dynamic CMOS logic. **(06 Marks)**
b. Explain bus arbitration logic with truthtable along with structured design. **(08 Marks)**
c. Explain Grey to binary code converters. **(06 Marks)**

Module-5

9 a. Illustrate two-phase clock generator using D flip-flops. **(08 Marks)**
b. Discuss Four-bit dynamic shift register with CMOS along with stick diagram. **(12 Marks)**

OR

10 a. Discuss optimization of CMOS inverter with necessary equation. **(10 Marks)**
b. Explain Aspects of design tools briefly. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | **21EC62**

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Microwave Theory 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. Derive Transmission line Equations in voltage and current forms. **(08 Marks)**

b. List the characteristics of Smith Chart. **(07 Marks)**

c. A certain transmission line has a characteristic impedance of $75 + j0.01\ \Omega$ and is terminated in a load impedance of $70 + j50\ \Omega$, compute
   (i) Reflection co-efficient
   (ii) Transmission co-efficient. **(05 Marks)**

OR

2 a. With neat diagram, explain the typical Microwave system. **(07 Marks)**

b. A transmission line has the following parameters, R = 2Ω/m, G = 0.5 mmho/m, f = 1 GHz, L = 8 nH/m, C = 0.23 PF.
Calculate (i) Characteristic impedance (ii) Propagation constant **(05 Marks)**

c. With the help of a functional block diagram, explain construction and modes of working of a GUNN Diode. **(08 Marks)**

Module-2

3 a. Write the S-matrix representation for Mutliport network. **(07 Marks)**

b. With a neat diagram, explain the working of precession type variable attenuator. **(08 Marks)**

c. A 20 mW signal is fed into one of the collinear Port 1 of a lossless H-plane T-junction. Calculate the power delivered through each port when other ports are terminated in Matched load. **(05 Marks)**

OR

4 a. State and explain the properties of S-matrix. **(07 Marks)**

b. What is Magic-tee? Derive its scattering matrix. **(07 Marks)**

c. In an H-plane T-junction, compute power delivered to the loads of 40 ohm and 60 ohm connected to arms-1 and 2 when a 10 mW power is delivered to the matched Port 3. **(06 Marks)**

Module-3

5 a. Discuss briefly Micro-strip lines and its losses and also derive the expression for Quality factor. **(08 Marks)**

b. Define the following terms with respect to antennas:
   (i) Radiation Intensity
   (ii) Beam area.
   (iii) Directivity
   (iv) Beam efficiency. **(08 Marks)**

c. A radio link has a 15 W transmitter connected to an antenna of 2.5 m^2 effective aperture at 5 GHz. The receiving antenna has an effective aperture of 0.5 m^2 and is located at 15 km line of sight distance from the transmitting antenna. Assume lossless antennas. Find the power delivered to the receiver. **(04 Marks)**

OR

6 a. A lossless parallel strip line has a conducting strip width W. The substrate dielectric separating the two conducting strips has a relative dielectric constant $\in_{rd}$ of 6 and a thickness d of 4 mm. Calculate
(i) The required width W of the conducting strip in order to have a characteristic impedance of 50 Ω.
(ii) The strip line capacitance.
(iii) The strip line inductance.
(iv) The phase velocity of the wave in the parallel strip lines. **(08 Marks)**

b. Show that maximum effective aperture of a λ/2 dipole antenna is 0.13 λ^2. **(06 Marks)**

c. Find the Directivity of the following using Exact method,
(i) $U = U_m \sin^2\theta \sin^3\phi$
(ii) $U = U_m \cos^4\theta \sin^2\phi$ where $0 \le \theta \le \frac{\pi}{2}$, $0 \le \phi \le 2\pi$. **(06 Marks)**

Module-4

7 a. Derive the expression and draw the field pattern for two isotropic point sources of the same Amplitude and same phase. **(08 Marks)**

b. Derive the expression for radiation resistance of short electric dipole. **(08 Marks)**

c. Find the length of an Elementary dipole having a radiation resistance of 5Ω at a frequency of 5 MHz. **(04 Marks)**

OR

8 a. Derive array factor expression in case of n isotropic point sources of equal Amplitude and spacing. **(07 Marks)**

b. Starting from Electric and Magnetic field potential, obtain the far field components for a short dipole. **(10 Marks)**

c. For a short dipole $\lambda/15$ long find the radiation resistance. **(03 Marks)**

Module-5

9 a. Obtain the expression for radiation resistance of small loop antenna. **(07 Marks)**

b. Briefly explain helical antenna with its helical geometry. **(05 Marks)**

c. Find the length L, H-plane aperture and flare angle θ_E and θ_H of pyramidal horn for which E-plane aperture is 10λ Horn is fed by a rectangular waveguide with TE_{10} mode. Assume $\delta = 0.2\lambda$ in E-plane and 0.375 λ in H-plane. Also find beam widths and directivity. **(08 Marks)**

OR

10 a. Derive the expression for strength E_ϕ and H_θ in case of small loop Antenna. **(08 Marks)**

b. Explain different types of Horn Antenna. **(06 Marks)**

c. Design Yagi-Uda antenna of six elements to provide a gain of 12 dB, if the operating frequency is 200 MHz. **(06 Marks)**

* * * * *

CBCS SCHEME

USN

21EC63

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
VLSI Design and Testing

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. Realize the CMOS compound gate for the following functions:
(i) $Y = \overline{ABC + D}$ (ii) $Y = \overline{A(B + C) + DE}$ **(08 Marks)**

b. Implement a positive edge triggered D flip flop using transmission gate and write the necessary timing diagram. **(08 Marks)**

c. Analyze the working of tristate inverter. **(04 Marks)**

OR

2 a. Draw the circuit diagram of CMOS inverter and derive its transfer characteristics by graphical method. **(06 Marks)**

b. Derive the equation for drain current of a MOSFET in non-saturated and saturated region of operation. **(10 Marks)**

c. Explain the following non-ideal effects of MOSFETs:
(i) Channel length modulation (ii) Mobility degradation. **(04 Marks)**

Module-2

3 a. With neat diagrams, explain the complete CMOS n-well fabrication process. **(10 Marks)**

b. Draw the layout diagram for the following function and also estimate the area.
$Y = \overline{(A + B + C)D}$ **(10 Marks)**

OR

4 a. Using Elmore delay model estimate the t_{pdf} and t_{pdr} of a 3-input NAND gate if the output is loaded with 'h' identical gates. **(08 Marks)**

b. Find the logical effort and parasitic delay of (i) 2 input NOR gate and (ii) 3-input NAND gate. **(06 Marks)**

c. Construct necessary equivalent circuit for the computation of t_{pdf} of an inverter driving another inverter using RC delay model. **(06 Marks)**

Module-3

5 a. With necessary circuit diagrams explain the operation of (i) 4 transistor DRAM and (ii) 3 transistor DRAM cells. **(10 Marks)**

b. Explain the operation of full CMOS SRAM cell with necessary circuit topology. **(06 Marks)**

c. Explain the hysteresis characteristics of ferroelectric capacitor with necessary diagram. **(04 Marks)**

OR

6 a. Explain the operation of 4×4 NOR based ROM array with necessary circuit diagram. **(08 Marks)**

b. With necessary circuit diagram and bias conditions, explain the operation of NOR flash memory. **(06 Marks)**

c. Explain binary tree based column decoder design with necessary diagram. **(06 Marks)**

Module-4

7 a. Differentiate between fault and failure with an example. Explain different types of stuck at fault with example. **(06 Marks)**

b. Explain feedback bridging fault with an example. **(06 Marks)**

c. For the circuit shown in Fig.Q7(c), using Boolean difference (i) detect s-a-0 and s-a-1 at x_1, (ii) determine partial Boolean difference for $x_2 - l - n - p - F$.

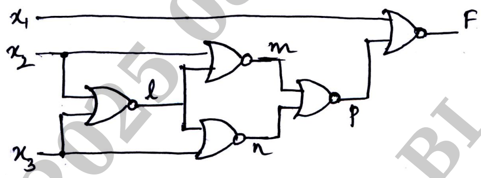


Fig.Q7(c) **(08 Marks)**

OR

8 a. What is fault diagnosis? Explain delay fault detection with an example. **(08 Marks)**

b. Find the test pattern for line 6 s-a-0 for the circuit shown in Fig.Q8(b) using D algorithm.

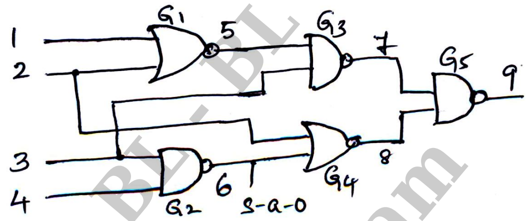


Fig.Q8(b) **(12 Marks)**

Module-5

9 a. For the state table shown in Table Q9(a), find
(i) Response for 010 sequence, (ii) Homing tree, (iii) Distinguishing tree.

Present State	Input	
	x = 0	x = 1
A	B, 0	D, 0
B	A, 0	B, 0
C	D, 1	A, 0
D	D, 1	C, 0

Table Q9(a) **(10 Marks)**

b. Write a note on functional fault model to detect faults in sequential circuits. **(05 Marks)**

c. Explain the process of testing sequential circuit as iterative combinational circuits. **(05 Marks)**

OR

10 a. Define the terms controllability and observability with an example. **(05 Marks)**

b. With a neat logic diagram, explain clocked hazard free latches used in LSSD technique. **(08 Marks)**

c. Explain partial scan technique using system clock with necessary diagram. **(07 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

21EC643

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Python Programming

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain for loop with respect to the range function with the help of an example. **(08 Marks)**

b. List out the boolean and comparison operators with their functions. **(07 Marks)**

c. Write a program to accept only the integer from the user and to classify the accepted input as even or odd number. Include try and except for input validation. **(05 Marks)**

OR

2 a. List any three built-in functions. Explain the definition and function call of the user defined functions along with parameter and return statements with example. **(08 Marks)**

b. List out the rules to be followed while creating the variables. Explain the significance of global statement with an example. **(07 Marks)**

c. Write a program to find the factorial of a number using function. **(05 Marks)**

Module-2

3 a. Explain the following with respect to lists with an example for each:
(i) Negative indexing (ii) Slicing
(iii) Concatenation (iv) Replication **(08 Marks)**

b. Explain the following dictionary methods with an example:
(i) keys( ), values( ), items( )
(ii) get( )
(iii) setdefault( ) **(07 Marks)**

c. Write a program using lists to store N numbers accepted from the user and to display the list average. **(05 Marks)**

OR

4 a. Explain any four list methods with an example for each. **(08 Marks)**

b. Explain all the is X string methods with an example for each. **(07 Marks)**

c. Write a program to create a dictionary of 10 items (USN: Marks) pairs by accepting the inputs from the user. Display the item with the maximum and minimum marks. **(05 Marks)**

Module-3

5 a. List out the steps involved in matching a regular expression. **(08 Marks)**

b. With the help of an example explain the variable saving process with shelve module. **(07 Marks)**

c. Write a program to find te total size of all the files in a directory. **(05 Marks)**

OR

6 a. Briefly explain character classes in Regular expression module. **(08 Marks)**

b. Explain the methods related to the absolute and relative paths. **(07 Marks)**

c. Write a program to search for lines having '@' sign between characters in a read text file. **(05 Marks)**

Module-4

7	a.	Explain pure and modifier functions with an example for each.	**(08 Marks)**
	b.	Explain operator overloading with an example.	**(07 Marks)**
	c.	Write a program that uses class to store the name and marks of students. Use list to store the marks in 3 subjects.	**(05 Marks)**

OR

8	a.	Explain classes, objects and attributes with an example. Show that objects ate mutable with the help of a snippet.	**(08 Marks)**
	b.	Explain _ _ init _ _ and _ _ str _ _ methods with an example.	**(07 Marks)**
	c.	Write a program to create two objects of the class point with x and y coordinates as attributes. Pass these two objects to a function which computes and displays the distance between the two points.	**(05 Marks)**

Module-5

9	a.	Explain HTML parsing using Beautiful-Soap with the help of an example.	**(08 Marks)**
	b.	Explain XML parsing with the help of an example.	**(07 Marks)**
	c.	Write a program to retrieve a text document from the web using urllib.	**(05 Marks)**

OR

10	a.	Explain JSON parsing with the help of an example.	**(08 Marks)**
	b.	Explain the creation of a database table with the help of an example.	**(07 Marks)**
	c.	Briefly explain the three kinds of keys used in database model.	**(05 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | **21EC653**

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
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. Brief the history of IC's with the help of Moore's law. **(04 Marks)**
b. Explain the working of nMOS transistor with the help of diagram. **(06 Marks)**
c. Derive the drain current Id in the saturation region and linear region. **(10 Marks)**

OR

2 a. Explain any two non-ideal I-V effects in MOSFET. **(08 Marks)**
b. With a neat block diagram, explain the n-well process. **(06 Marks)**
c. Compare CMOS with bipolar technologies. **(06 Marks)**

Module-2

3 a. Draw the stick diagram of a two input NAND gate. **(04 Marks)**
b. Elaborate the lambda based design rules for nMOS and CMOS (wires and contact cuts). **(10 Marks)**
c. Derive an expression for sheet resistance with the help of sheet resistance model. **(06 Marks)**

OR

4 a. With the help of rise time and fall time model diagram, derive rise time estimation τ_r and fall time estimation τ_f. **(10 Marks)**
b. Explain super buffers in detail. **(06 Marks)**
c. Explain briefly how a cascaded inverters are used as drivers. **(04 Marks)**

Module-3

5 a. List the scaling factors for all the device parameters. **(08 Marks)**
b. Elaborate the general consideration in the subsystem design processes. **(04 Marks)**
c. With a neat block diagram, explain the general arrangement of a 4 bit arithmetic processor. **(08 Marks)**

OR

6 a. Explain the design of an ALU sub system. **(08 Marks)**
b. Elaborate the design of a 4 bit adder circuit. **(06 Marks)**
c. Explain the Manchester – carry – chain technique used in adders. **(06 Marks)**

Module-4

7	a.	Explain switch logic with the help of pass transistors and transmission gates.	**(10 Marks)**
	b.	With a neat block diagram, explain the concept f parity generator.	**(05 Marks)**
	c.	Explain the four way multiplexer in sub system design process.	**(05 Marks)**

OR

8	a.	Explain how the placement is accomplished in the physical design for FPGA's.	**(10 Marks)**
	b.	Elaborate the design abstraction ladder for FPGA's.	**(05 Marks)**
	c.	With a neat diagram, explain the architecture of FPGA.	**(05 Marks)**

Module-5

9	a.	List any six system timing considerations.	**(06 Marks)**
	b.	Explain how the read and write operations are performed in four transistor dynamic CMOS memory cells.	**(08 Marks)**
	c.	Write short notes on controllability and observability in VLSI testing.	**(06 Marks)**

OR

10	a.	Explain the different types of fault models used in VLSI testing.	**(06 Marks)**
	b.	Explain in detail about the logical verification principles.	**(06 Marks)**
	c.	Draw a pseudo random sequence generator and explain how it is applied in BIST.	**(08 Marks)**

* * * * *

USN | | | | | | | | | | | **18EC733**

Seventh Semester B.E. Degree Examination, Dec.2024/Jan.2025
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. With neat diagram, explain the fundamental steps in Digital Image Processing. **(10 Marks)**

b. Explain the method of image Acquisition using a single sensor and linear sensor strip. **(10 Marks)**

OR

2 a. A common measure of transmission for digital data is the baud rate. Generally transmission is accomplished in packets consisting of a start bit, a byte (8 bits) of information and a stop bit. Using these facts answer the followings :

i) How many minutes would it take to transmit a 1024 × 1024 image with 256 gray levels using 56K baud modem?

ii) What would the time be at 750 K baud a representative speed of a phone DSL connection? **(08 Marks)**

b. Explain the following :

i) Image formation in the eye

ii) Brightness Adaptation and Discrimination **(12 Marks)**

Module-2

3 a. Illustrate the concept of sampling and quantization. **(08 Marks)**

b. Consider the two image subsets S_1 and S_2, shown in the Fig Q3(b). For V = {1}, determine whether these two subsets are i) 4 – adjacent ii) 8 – adjacent iii) m – adjacent.

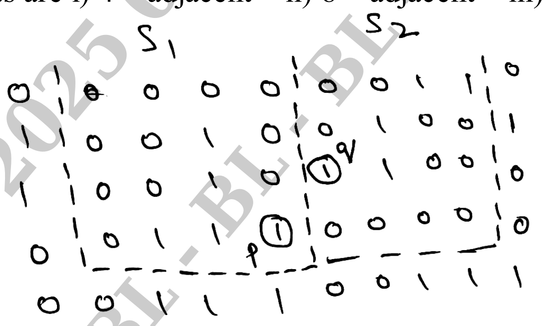


Fig Q3(b) **(08 Marks)**

c. What is linear and Non-linear operations in image processing. **(04 Marks)**

OR

4 a. Explain the various relationships between pixels. **(10 Marks)**

b. Explain the following Gray level transformation

i) log transformation

ii) Power – Law Transformation. **(10 Marks)**

Module-3

5 a. Explain the basic steps for Filtering in the frequency domain with the help of block diagram. **(08 Marks)**

b. Describe the following smoothing frequency – domain filters
   i) Ideal Lowpass Filters
   ii) Butterworth Lowpass Filters **(12 Marks)**

OR

6 a. Explain the following sharpening frequency Domain filters. **(12 Marks)**
   i) Ideal Highpass filters
   ii) Laplacian in the frequency domain.

b. Explain the Homomorphic filtering approach for image enhancement. **(08 Marks)**

Module-4

7 a. Explain various probability density functions used in image processing applications. **(12 Marks)**

b. Describe the various mean filters used to restoration in the presence of Noise. **(08 Marks)**

OR

8 a. Explain Estimating the degradation function by
   i) Image observation
   ii) Experimentation **(12 Marks)**

b. Explain Minimum Mean Square Error Filtering. **(08 Marks)**

Module-5

9 a. Explain the following Morphological operations
   i) Dilation
   ii) Erosion **(14 Marks)**

b. Mention the properties of opening and closing operations in morphological image processing. **(06 Marks)**

OR

10 a. Explain the following color models
   i) CMY color model
   ii) HSI floor model **(12 Marks)**

b. Describe the Pseudocolor coding approach for color modeling. **(08 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

18EC741

Seventh Semester B.E. Degree Examination, Dec.2024/Jan.2025

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. Describe about the IoT conceptual framework. **(06 Marks)**
b. Describe the IoT reference model suggested by CISCO for a general IoT system. **(08 Marks)**
c. Explain COAP web communication protocol in detail. **(06 Marks)**

OR

2 a. What is M2M communication? Differentiate M2M and IoT. **(06 Marks)**
b. Explain the IoT architectural view with the help of Oracle's IoT architecture. **(08 Marks)**
c. Explain the usage of XMPP protocol for IoT with working. **(06 Marks)**

Module-2

3 a. Explain IP addressing and features of IPV4 and IPV6 protocols. **(06 Marks)**
b. Describe the virtualization concept in usage of cloud services. **(06 Marks)**
c. List the merits and concerns when using the cloud services in IoT applications. **(08 Marks)**

OR

4 a. With neat diagram, explain 6LoWPAN adaptation layer protocol for IEEE 802.15.4 network device. **(08 Marks)**
b. Explain data stack received or transmitted at or to network layer in IPV4. **(06 Marks)**
c. Describe the usage and functionalities of Nimbits cloud for IoT applications. **(06 Marks)**

Module-3

5 a. Explains how are pins programmed for digital IO and UART serial IO's at Arduino platform. **(10 Marks)**
b. List the steps in threat analysis when using Microsoft Threat Analysis Tool 2014. **(10 Marks)**

OR

6 a. Explain the programming of Arduino of following:
i) Read data from sensor
ii) Usage of Timer. **(10 Marks)**
b. Define security tomography. Explain layered attacker model with a diagram showing possible attacks at the layers. **(10 Marks)**

Module-4

7 a. Explain about the energy consumption of hardware components of sensor nodes. **(10 Marks)**
b. Explain the required characteristics and mechanism to realize the wide range of applications. **(10 Marks)**

OR

8	a.	Explain the basic design principles required to design a networking protocols of WSN.	**(10 Marks)**
	b.	Explain the different optimization design parameters involved in the WSN.	**(10 Marks)**

Module-5

9	a.	Explain LEACH schedule based protocols.	**(10 Marks)**
	b.	Define geo casting. Explain in detail about geo casting.	**(10 Marks)**

OR

10	a.	Explain the CSMA contention based protocol in detail.	**(10 Marks)**
	b.	Explain in detail how unicast routing protocols uses the energy efficiency.	**(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

18EC751

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
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. Describe the functional block diagram of an electronic communication system. **(06 Marks)**

b. Explain the following mechanism of propagation
i) Ground wave ii) Sky wave iii) Space wave. **(06 Marks)**

c. Define the following terms with respect to antenna :
i) Directivity ii) Effective area iii) Efficiency iv) Antenna radiation pattern. **(08 Marks)**

OR

2 a. Define modulation. Explain the need for modulation. **(06 Marks)**

b. Explain the advantages of using digital transmission techniques over analog transmission techniques. **(06 Marks)**

c. A wireless communication transmitter has an output power of 165 watts at a carrier frequency of 325 MHz. It is connected to an antenna with a gain of 12 dBi. The receiving antenna is 15 Km away and has again of 6 dBi. Calculate the power delivered to the receiver, considering free space propagation. Assume that there are no other losses or mismatches in the system. **(08 Marks)**

Module-2

3 a. Differentiate between the high and low power AM transmitters in context to their functional block diagrams. **(05 Marks)**

b. Explain the principles of amplitude modulation with neat waveforms and related equations. **(10 Marks)**

c. Briefly explain the different types of external noises. **(05 Marks)**

OR

4 a. Explain the operation of Am super heterodyne receiver with neat block diagram. **(06 Marks)**

b. Explain square law diode modulator with circuit and related equations. **(06 Marks)**

c. An AM signal has a peak unmodulated carrier voltage, V_c = 100V, a load resistance, $R_L = 50\Omega$ and a modulation index $\mu_a = 1$. Determine the following :
i) Carrier power ii) Lower side band and upper side band power iii) Total sideband power iv) Total power of modulated AM signal v) Sketch the AM power spectrum. **(08 Marks)**

Module-3

5 a. State and prove sampling theorem for baseband signals. **(10 Marks)**

b. Explain Pulse Amplitude Modulation (RAM) with waveforms and three distinct methods of sampling in PAM. **(10 Marks)**

OR

6 a. With neat block diagram, explain the operation of PCM system. **(10 Marks)**

b. Why non-uniform quantization in necessary? Explain different types of companding techniques with their characteristic curves. **(10 Marks)**

Module-4

7 a. Explain Amplitude Shift Keying (ASK) with related waveforms. Also explain the ASK modulator with neat block diagram. **(08 Marks)**

b. Consider four messages generated buy a source with the probabilities $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{8}$ respectively. Assume noiseless channel and compute coding efficiency if a binary code is applied for coding messages. **(06 Marks)**

c. Explain Shannon's sources coding theorem. **(06 Marks)**

OR

8 a. Explain the objectives of source coding and the need of channel coding. **(06 Marks)**

b. Explain coherent BFSK demodulator with neat block diagram. **(06 Marks)**

c. Explain the following error correction techniques
i) Automatic Retransmission Request (ARQ) ii) Forward Error Correction (FEC). **(08 Marks)**

Module-5

9 a. Explain the applications of wireless communications. **(10 Marks)**

b. Explain the concept of frequency reuse and the method of locating co-channel cells in a cellular system with the help of required neat diagrams. **(10 Marks)**

OR

10 a. Explain the advantages and disadvantages of the wireless communication. **(10 Marks)**

b. A mobile communication system is allocated RF spectrum of 25 MHz and uses RF channel bandwidth of 25 KHz so that a total number of 1000 voice channels can be supported in the system. i) If the service area is divided into 20 cells with a frequency reuse factor of 4, compute the system capacity ii) The cell size is reduced to the extent that the service area is now covered with 100 cells. Compute the system capacity while keeping the frequency reuse factor as 4. **(10 Marks)**

* * * * *

CBCS SCHEME

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

21EC71

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Advanced VLSI

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain ASIC design flow with neat flow chart. **(10 Marks)**

b. Explain Booth Encoding multiplier with an example. **(10 Marks)**

OR

2 a. Describe different cell compilers and I/O cells. **(10 Marks)**

b. With a neat diagram, explain the operation of conditional sum adder. Mention its advantages and disadvantages. **(10 Marks)**

Module-2

3 a. Explain the concept of measurement of delay in Floorplanning. **(10 Marks)**

b. Explain the following :
i) Power planning ii) Clock planning **(10 Marks)**

OR

4 a. Write an algorithm for iterative placement improvement method and explain briefly. **(10 Marks)**

c. Explain the goals and objectives of global routing in detail. **(10 Marks)**

Module-3

5 a. Explain factors in randomizing the stimulus to a design. **(10 Marks)**

b. Draw the diagram of layered test bench of system verilog and describe the function of each layer. **(10 Marks)**

OR

6 a. Describe the various array methods with an example. **(08 Marks)**

b. Describe type def and enumerated data types with example. **(06 Marks)**

c. Explain constant and strings in system verilog with example. **(06 Marks)**

Module-4

7 a. Explain Tasks, functions and void function in system verilog. **(06 Marks)**

b. How time values are specified in system verilog, describe with example. **(06 Marks)**

c. Explain automatic storage and variable initialization with system verilog program example. **(08 Marks)**

OR

8 a. Describe the communication between the test bench and DUT with suitable diagram and system verilog program. **(10 Marks)**

b. Explain different types of system verilog assertions with example. **(10 Marks)**

Module-5

9	a.	Explain common randomization problems in brief.	**(10 Marks)**
	b.	Write any 4 Random Number functions with an example.	**(04 Marks)**
	c.	Explain Pseudorandom Number Generators (PRNG) in system verilog.	**(06 Marks)**

OR

10	a.	What is coverage? Explain coverage types in system verilog.	**(10 Marks)**
	b.	Describe various coverage options with an example.	**(10 Marks)**

* * * * *

CBCS SCHEME

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

21EC72

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Optical and Wireless Communication

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Briefly explain with a neat figure the propagation mechanism of meridional rays in an ideal step index optical waveguide. **(08 Marks)**

b. Define the term attenuation in optical fibers. Explain the different attenuation mechanisms in optical fibers. **(12 Marks)**

OR

2 a. Define Dispersion. Briefly explain intermodal and intramodal dispersion effects in optical waveguide. **(10 Marks)**

b. With neat figures, discuss the structure of single mode and multimode step-index and graded index optical fibers. **(06 Marks)**

c. A multimode fiber has a core refractive index of 1.480 and a core cladding index difference of 2.0 percent. Find the numerical aperture and critical angle at the core cladding interface. **(04 Marks)**

Module-2

3 a. What are the characteristic requirements of an optical source? With the help of neat diagram, explain the constructional features and emission pattern of surface emitting LED. **(10 Marks)**

b. Define optical isolator. With a neat figure, explain the design and operation of a polarization independent isolator. **(06 Marks)**

c. A given silicon avalanche photodiode has a quantum efficiency of 65 percent at a wavelength of 900 nm. If 0.5 μw of optical power produces a multiplied photocurrent of 10 μA. What is the multiplication M? **(04 Marks)**

OR

4 a. Discuss the operation of pin photodiode with a neat circuit and energy band diagram. **(10 Marks)**

b. What is Diffraction gratings? Discuss briefly Diffraction grating techniques. **(10 Marks)**

Module-3

5 a. Explain briefly the different propagation mechanisms that influence the signal propagation in a mobile communication environment. **(10 Marks)**

b. A cellular communication service area is covered with 12 clusters having 7 cells in each cluster and 16 channels assigned in each cell. Find the number of channels per cluster and the system capacity. **(03 Marks)**

c. Explain how the concept of frequency reuse increases the spectrum efficiency that inturn increases the cellular communication system capacity. **(07 Marks)**

OR

6 a. Briefly discuss the generations of wireless communication network technology. **(08 Marks)**

b. Discuss the effects of co-channel interference in wireless communication in reducing the system capacity. **(05 Marks)**

c. Discuss the concept of multipath fading in mobile communication system. **(07 Marks)**

Module-4

7 a. With a neat block diagram, explain the operation of basic TDMA link. **(10 Marks)**

b. Explain the basic cellular system with necessary block diagram. **(10 Marks)**

OR

8 a. Discuss with a neat figure the call processing in a cellular system for mobile-originated calls. **(12 Marks)**

b. List the advantages of CDMA over TDMA and FDMA. **(08 Marks)**

Module-5

9 a. What is Hand off in GSM networks? Explain briefly the different handoff procedure in GSM. **(10 Marks)**

b. Explain the functions of data bases HLR and VLR at MSC in GSM network architecture and also explain how it is helpful in location updation in GSM networks. **(10 Marks)**

OR

10 a. Briefly explain the three major subsystems in GSM network architecture with a neat block diagram. **(10 Marks)**

b. Explain briefly the following identifiers in GSM system:
(i) SIM
(ii) Mobile system ISDN with frame format
(iii) Location Area Identify **(10 Marks)**

* * * * *

CBCS SCHEME

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

21EC733

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
DSP Algorithms and Architectures

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 describe the features to be considered in designing and implementing a DSP system. **(06 Marks)**

b. Determine the interpolated sequences y(n) with input sequence x(n) = {0, 3, 6, 9, 12} using an interpolation filter $b_k = \left[\frac{1}{3}, \frac{2}{3}, 1, \frac{2}{3}, \frac{1}{3}\right]$ and interpolation factor L = 3. **(06 Marks)**

c. Outline a DSP system with the help of block diagram and its typical signals. **(08 Marks)**

OR

2 a. Discuss the major features of programmable Digital signal processes. **(08 Marks)**

b. Evaluate Decimation and interpolation process with relevant equations. **(08 Marks)**

c. Determine complex multiplies for Direct DFT and FFT based DFT computations for N = 4. **(04 Marks)**

Module-2

3 a. Discuss MAC limit with Guard bits and saturation logic. **(10 Marks)**

b. Explain Braun multiplier and Barrel shifter. **(10 Marks)**

OR

4 a. Illustrate special addressing modes of DSP system. **(10 Marks)**

b. Illustrate single MAC pipelined implementation of an 8-tap filter with relevant diagrams. **(10 Marks)**

Module-3

5 a. Relate Direct and Indirect addressing modes with suitable block diagram for TMS320C54XX processors. **(08 Marks)**

b. What are PMST and TCR registers? Explain with their bit format. **(06 Marks)**

c. Discuss the following instructions
i) MAS ii) MACD iii) RPTB. **(06 Marks)**

OR

6 a. Write a program to compute the sum of product term given by the equation
$y(n) = h_0x(n) + h_1x(n-1) + h_2\,x(n-2)$
use direct addressing mode to access the data memory. **(10 Marks)**

b. Describe pipelining operation in TMS320C54XX processor. Give pipeline operation of given sequence

```
LD *AR3+, A
ADD#1000h, A
STL A, *AR3 +
.
.
.
```

(10 Marks)

Module-4

7 a. Write a program to implement the FIR fitter for TMS320C54XX processors. **(10 Marks)**

b. Why polyphase subfilters are required in interpolation filters? Explain Digital interpolation implementation using five polyphase subfilters with interpolation factor 5. **(10 Marks)**

OR

8 a. Describe the following with FFT computation

i) Overflow and scaling

ii) Bit – relevant Index Generation **(10 Marks)**

b. Design and implement a general DIT – FFT buttery in place computation. Give its structure. **(10 Marks)**

Module-5

9 a. Interface the TMS320C54XX to a 10 bit ADC (TLC1550) and an 8-bit DAC (TLC7524). The sampled signal read from the ADC is to be written to the DAC after adjusting its size. The start of the conversion is to be initiated by the TOUT signal of the timer. **(12 Marks)**

b. Outline Register subaddressing technique for configuration DMA operation. **(08 Marks)**

OR

10 a. Describe the block diagram for the PCM3002 codec. **(10 Marks)**

b. Discuss with suitable block diagram JPEG encoding and JPEG decoding process. **(10 Marks)**

* * * * *

USN | | | | | | | | | |

21EC741

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
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. Define IoT. Explain the characteristics of IoT. **(06 Marks)**
b. Explain the different communication models in logical design of IoT. **(08 Marks)**
c. Explain the IoT level-1, IoT level-2 IoT level-3 with relevant block diagrams. **(06 Marks)**

OR

2 a. With respect to physical design of the IoT, explain the following :
i) Things in IoT
ii) IoT protocols. **(08 Marks)**
b. Explain any three IoT enabling technologies. **(06 Marks)**
c. Explain the IoT level-5, and IoT level-6 with neat block diagram. **(06 Marks)**

Module-2

3 a. Explain the following applications of IoT with respect to home automation :
i) Smart lighting
ii) Smart appliances
iii) Intrusion detection
iv) Smoke/gas detectors. **(10 Marks)**
b. Analyze the applications of IoT in environment domain. **(10 Marks)**

OR

4 a. Explain the different applications of IoT for cities. **(10 Marks)**
b. Analyze the applications of IoT in the following domains :
i) Agriculture
ii) Industry. **(10 Marks)**

Module-3

5 a. Explain the applications of the sensor networks. **(06 Marks)**
b. Mention the characteristic features of sensor networks. With a neat block diagram explain the components present in a typical sensor node. **(08 Marks)**
c. Analyze category 1 wireless sensor network applications for :
i) Highway monitoring
ii) Wildfire instrumentation. **(06 Marks)**

OR

6 a. With a neat diagram, explain the basic sensor network architectural elements. **(06 Marks)**
b. Analyze category 2 wireless sensor network applications for home control and building automation. **(08 Marks)**
c. Explain the challenges and hurdles of wireless sensor networks. **(06 Marks)**

Module-4

7 a. With a neat block diagram, explain the hardware and software components of Wireless Nodes (WNs). **(10 Marks)**

b. Explain the following wireless transmission technologies for campus applications :
i) Bluetooth
ii) WLAN. **(10 Marks)**

OR

8 a. Explain the wireless node (WN) operating environment with respect to :
i) Resource constraints
ii) Design constraints. **(10 Marks)**

b. Explain the 3G cellular networks (a wireless transmission technology) for MAN/WAN applications. **(10 Marks)**

Module-5

9 a. Explain the Wireless Sensor Network (WSN) middleware principles. **(06 Marks)**

b. Explain the data related functions for middleware in Wireless Sensor Networks (WSN). **(08 Marks)**

c. Explain the different performance metrics of Wireless Sensor Networks (WSNs). **(06 Marks)**

OR

10 a. Explain general middleware architecture for wireless sensor networks (WSNs). **(06 Marks)**

b. Explain the following related to Wireless Sensor Network (WSN) design issues :
i) MAC protocols
ii) Routing protocols
iii) Transport protocols. **(08 Marks)**

c. Explain the basic performance models of wireless sensor networks (WSNs). **(06 Marks)**

* * * * *

CBCS SCHEME

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

21EC752

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

ARM 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 RISC Design Phylosophy. Also highlight complexity parameter of RISC and CISC. **(10 Marks)**

b. Discuss Embedded System Hardware along with an embedded device example. **(10 Marks)**

OR

2 a. List and explain general purpose registers, also discuss a generic program status register. **(10 Marks)**

b. Explain exceptions, interrupts and write the vector table. **(10 Marks)**

Module-2

3 a. List and explain Load-Store Instructions. **(10 Marks)**

b. Explain Program Status Register Instructions with PSR byte fields. **(10 Marks)**

OR

4 a. List and explain the Data Processing Instructions. **(10 Marks)**

b. Discuss stack instructions and Software Interrupt Instructions. **(10 Marks)**

Module-3

5 a. Differentiate between Embedded Systems and general purpose computing systems. **(05 Marks)**

b. Classify the embedded systems based on different criteria in detail. **(05 Marks)**

c. Explain the purpose of Embedded Systems. **(10 Marks)**

OR

6 a. Differentiate between:
(i) RISC and CISC (ii) Hardware and Von-Neumann processor architecture **(10 Marks)**

b. Explain I_2C Bus in detail with neat diagram. **(10 Marks)**

Module-4

7 a. List and explain characteristics of an embedded system. **(10 Marks)**

b. Discuss quality attributes of embedded systems. **(10 Marks)**

OR

8 a. List and explain fundamental issues in hardware-software co-design. **(10 Marks)**

b. Discuss embedded firmware deign approaches. **(10 Marks)**

Module-5

9 a. Explain the types of operating systems. **(10 Marks)**

b. Discuss tasks and process with necessary diagram. **(10 Marks)**

OR

10 a. Explain preemptive scheduling. **(10 Marks)**

b. Write a short note on simulators, emulators and debuggers. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | | **18EC824**

Eighth Semester B.E. Degree Examination, Dec.2024/Jan.2025s

Optical 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. Define Numerical Aperture(NA) and the acceptance angle θ_a with reference to meridional ray propagation in an optical fiber. With a neat optical meritional ray diagram and by derivation relate :
i) NA with core-cladding refractive indices as well as with θ_a
ii) NA with the index difference Δ_n
iii)NA with relative refractive index Δ. **(10 Marks)**

b. A typical relative refractive index difference for an optical fiber is 1%. Estimate the NA and the solid acceptance angle in air, when the core RI is 1.46. Also calculate the critical angle ϕ_C at the core-cladding interface. Assume that concepts of ray optics theory hold good for the fiber. **(05 Marks)**

c. Outline and briefly explain any five advantages of optical fiber channels over copper wire/coaxial cable channels that are used in communication links as the transmission media. **(05 Marks)**

OR

2 a. Compare the meridional rays and skew rays in a light guiding optical fiber. **(04 Marks)**

b. With a neat sketches of refractive index profile and light ray propagations, explain the features of :
i) Multimode step index fiber
ii) Single mode step index fiber
iii) Multimode graded index fiber (parabolic RI profile). **(10 Marks)**

c. With a neat diagram, explain the construction and features of the two types of photonic crystal fibers (PCFs). **(06 Marks)**

Module-2

3 a. Discuss the absorption losses due to the materials of silica glass fibers. **(06 Marks)**

b. Draw a neat diagram that represents the fiber bending loss and briefly explain the phenomenon of bending loss along with the expressions for the critical value of radius of curvature of fiber bend. How such bending losses can be reduced? **(08 Marks)**

c. Write a brief note on mechanical misalignments at the joint between two optical fibers with appropriate simple diagrams. **(06 Marks)**

OR

4 a. With a neat set up diagram, explain the fusion splicing technique of optical fibers. Mention any two disadvantages of this technique. **(07 Marks)**

b. Briefly explain any six principal features and requirements of a good fiber connector. **(06 Marks)**

c. A 32 × 32 port multimode fiber transmissive star coupler has 1 mW of optical power launched into a single input port. The average optical power measured at each output port is 14 μW. Calculate the total loss incurred by the start coupler and the average insertion loss through the coupler. **(07 Marks)**

Module-3

5 a. With a neat diagram, explain the construction and optical emission features of a surface emitting LED structure. **(07 Marks)**

b. Mention any four difference between LEDs and LASER diodes. **(04 Marks)**

c. Starting from rate equations derive an expression for the total number of photon emission from a LASER diode (i.e expression for stimulated photon emission plus spontaneous photon emission). **(09 Marks)**

OR

6 a. Mention any five performance requirements of a photo detector to be used in an optical receiver. **(05 Marks)**

b. 6 × 106 photons at a wavelength of 1300 nm fall on an InGaAs photo-detector. An average of 5.4×10^6 electron –hole pairs are generated. Calculate :

i) The quantum efficiency η

ii) Responsivity R of the photo-detector. **(04 Marks)**

c. Draw the neat block diagram of a typical digital optical fiber transmission-reception link along with optical and electrical pulse signals at different stages of the link. Explain the functions of the different blocks involved in that link. **(11 Marks)**

Module-4

7 a. Explain the operational principles and implementation of a WDM optical network with a neat schematic. **(06 Marks)**

b. Explain the construction and working of a dielectric thin film optical filter. **(06 Marks)**

c. With appropriate diagrams, explain the construction and operation of reflection and transmission type diffraction gratings. **(08 Marks)**

OR

8 a. With a neat diagram, explain the operation of a MEMS technology based actuation mechanism. **(06 Marks)**

b. Explain the construction and working an optical isolator with neat diagrams. **(06 Marks)**

c. Based on the general applications, explain the three types of optical amplifiers with relevant diagrams. **(08 Marks)**

Module-5

9 a. What are the four basic functions performed by an optical packet switch? Show the overall structural format of a typical packet used in the optical packet switched network and briefly explain. **(07 Marks)**

b. With a neat diagram, explain the optical circuit switched network. **(06 Marks)**

c. Briefly explain each of the seven layers of OSI reference model in terms of the functions performed. **(07 Marks)**

OR

10 a. With a neat diagram, explain the optical public telecommunication network hierarchy. **(07 Marks)**

b. Show the structure of a metropolitan area network and explain. **(06 Marks)**

c. Briefly explain the generic Optical Label Switched (OLS) network configuration with a neat block diagram. **(07 Marks)**

* * * * *