

CBCS SCHEME

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21EC33

Third Semester B.E./B.Tech. Degree Examination, June/July 2025 Basic Signal Processing

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- Define vector subspaces and explain the four fundamental subspaces. (06 Marks)
 - Determine whether the vectors $V_1 = (1, 2, 3)$, $V_2 = (3, 1, 7)$ and $V_3 = (2, 5, 8)$ are linearly dependent or linearly independent. (08 Marks)
 - Explain linear transformation in detail. (06 Marks)

OR

- Determine whether or not each of the following forms a basis $x_1 = (2, 2, 1)$, $x_2 = (1, 3, 7)$ and $x_3 = (1, 2, 2)$ in R^3 . (08 Marks)

b. If $U = \begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix}$; $V = \begin{bmatrix} 2 \\ -2 \\ 1 \end{bmatrix}$; $W = \begin{bmatrix} 2 \\ 1 \\ -2 \end{bmatrix}$

Then show that U, V, W are pair-wise orthogonal vectors. Find the lengths of u, v, w and find orthonormal vectors U_1, V_1, W_1 from vectors U, V, W . (12 Marks)

Module-2

- If $A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$, find eigen values and eigen vectors for matrix A . (08 Marks)
 - Diagonalize the matrix: $A = \begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$. Find an invertible matrix P and a diagonal matrix D such that $A = PDP^{-1}$ and hence find A^3 . (12 Marks)

OR

- What is the positive definite matrix? Mention the methods of testing positive definiteness. (04 Marks)

b. Test to see if $A^T A$ is positive definite: $A = \begin{bmatrix} 1 & 1 \\ 1 & 2 \\ 2 & 1 \end{bmatrix}$. (04 Marks)

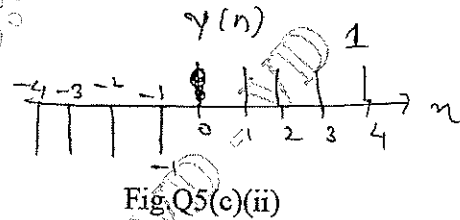
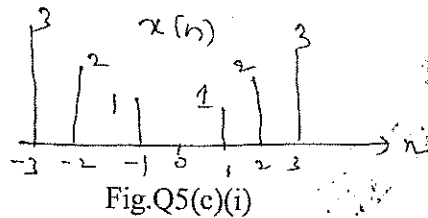
- Factorize the matrix A into $A = U\Sigma V^T$ using SVD.

$A = \begin{bmatrix} 2 & 3 \\ 0 & 2 \end{bmatrix}$

(12 Marks)

Module-3

- 5 a. Define signals and system with examples. (05 Marks)
 b. Explain elementary discrete signals : (05 Marks)
 i) Exponential ii) Sinusoidal iii) Step iv) Impulse functions.
 c. The discrete-time signals $x(n]$ and $y(n]$ are shown in Fig.Q5(c)(i) and Fig.Q5(c)(ii) respectively sketch the signal $z(n) = x(2n) y(n-4)$. (10 Marks)



OR

- 6 a. State and explain the properties : (08 Marks)
 i) Linearity ii) Time-invariance iii) Memory iv) Causality.
 b. For the following system, determine whether the system is : (12 Marks)
 i) Linear ii) Time-invariance iii) Memoryless iv) Causal v) Stable
 $T\{x(n)\} = x(-n)$.

Module-4

- 7 a. Evaluate the discrete – time convolution sum given below : $y(n) = u(n) * u(n-3)$. (08 Marks)
 b. Consider a input $x(n]$ and a unit impulse response $h(n]$ given by :
 $x(n) = \alpha^n u(n) : 0 < \alpha < 1$
 $h(n) = u(n)$
 Evaluate and plot the output signal $y(n)$. (12 Marks)

OR

- 8 a. Obtain the unit-step response for LTI system. (06 Marks)
 b. Determine a discrete-time LTI system characterized by impulse response :
 $h(n) = \left(\frac{1}{2}\right)^n u(n)$ is : i) Stable ii) Causal iii) Memory. (06 Marks)
 c. Find the step response for the LTI system represented by the impulse response :
 $h(n) = \left(\frac{1}{2}\right)^n u(n)$. (08 Marks)

Module-5

- 9 a. Explain briefly the RoC and its important properties. (06 Marks)
 b. State and prove shifting and scaling properties of Z-transform. (06 Marks)
 c. Find the Z-transform of the signal using properties :
 $x(n) = \left(\frac{1}{2}\right)^n u(n) * \left(\frac{1}{3}\right)^n u(n)$. (08 Marks)

OR

- 10 a. Find the inverse Z-transform of the following using partial fraction expansion method.
 $X(z) = \frac{1+2z^{-1}+z^{-2}}{1-\frac{3}{2}z^{-1}+\frac{1}{2}z^{-2}}$ RoC $|z| > 1$. (08 Marks)
 b. A system has impulse response $h(n) = \left(\frac{1}{2}\right)^n u(n)$. Determine the input to the system if the output is given by $y(n) = \frac{1}{3} u(n) + \frac{2}{3} \left(-\frac{1}{2}\right)^n u(n)$. (08 Marks)
 c. Define causality and stability of the Z-transform. (04 Marks)

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21EC42

Fourth Semester B.E./B.Tech. Degree Examination, June/July 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. Find the 16 point DFT of a signal
- $$x(n) = \begin{cases} \frac{1}{2} & n \leq 0 \\ 1 & 1 \leq n \leq 15 \end{cases} \quad (08 \text{ Marks})$$
- b. With neat diagram, explain frequency domain sampling and reconstruction of discrete time signals. (08 Marks)
- c. The first five values of an 8 point DFT of real valued sequence are $(4, 1-j1, 0, 1+j2, 0)$. Find the remaining values of the DFT. (04 Marks)

OR

- 2 a. Determine 8 point DFT of $x(n) = [1, 1, 1, 1, 0, 0, 0, 0]$. (10 Marks)
- b. Determine 4 point circular convolution between $x_1(n) = [1, 2, 2, 1]$ and $x_2(n) = [1, 1]$ using DFT and IDFT method. (10 Marks)

Module-2

- 3 a. State and prove Parseval's theorem in DFT. (06 Marks)
- b. Using overlap save method, compute $y(n)$ of a FIR filter with impulse response $h(n) = [3, 2, 1]$ to an input $x(n) = [2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1]$. Use only 8-point circular convolution. (08 Marks)
- c. For the sequences $x_1(n) = \cos\left(\frac{2\pi n}{N}\right)$ and $x_2(n) = \sin\left(\frac{2\pi n}{N}\right)$, $0 \leq n \leq N-1$, determine N point circular correlation of $x_1(n)$ and $x_2(n)$. (06 Marks)

OR

- 4 a. Using overlap add method, compute $y(n)$ of a FIR filter with impulse response $h(n) = [1, 2, 1]$ to an input sequence $x(n) = [1, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 2, 1]$, use only 6-point circular convolution. (10 Marks)
- b. Find the DFT of a sequence $x(n) = [1, 2, 3, 4, 4, 3, 2, 1]$ using radix 2 DIT - FFT algorithm. (10 Marks)

Module-3

- 5 a. Design a FIR filter with a desired frequency response
- $$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}, & -\frac{3\pi}{4} \leq \omega \leq \frac{3\pi}{4} \\ 0; & \frac{3\pi}{4} < |\omega| < \pi \end{cases} \quad \text{Also obtain the frequency response.} \quad (10 \text{ Marks})$$
- b. A FIR filter is given by difference equation
- $$y(n] = x(n) + \frac{2}{5}x(n-1) + \frac{3}{4}x(n-2) + \frac{1}{3}x(n-3). \quad \text{Draw the corresponding direct Form - I and lattice structure.} \quad (10 \text{ Marks})$$

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

OR

- 6 a. Given $H(z) = (1 + 0.6z^{-1})^5$. Realize in direct form and cascade of first and second order sections. (10 Marks)
- b. Determine filter coefficients $h(n)$ of a FIR filter with a desired frequency response.

$$H_d(w) = \begin{cases} e^{-2w} & -\pi/4 \leq w \leq \pi/4 \\ 0 & \pi/4 \leq |w| \leq \pi \end{cases} \text{ use Hamming window.} \quad (10 \text{ Marks})$$

Module-4

- 7 a. Derive the expression for the order of Butterworth filter. (06 Marks)
- b. The system function of the analog filter is given as $H_a(S) = \frac{S+0.1}{(S+0.1)^2+16}$. Obtain the system function of the digital filter using bilinear transformation. Assume $T = 2$ seconds. (06 Marks)
- c. Design a digital Butterworth filter with a maximum pass band attenuation 3.01 dB at pass band edge frequency 500Hz and stop band attenuation of 15 dB at stop band edge frequency 750 Hz. Sampling rate of 2 KHz. (08 Marks)

OR

- 8 a. A system is specified by its transfer function $H(z) = \frac{(z-1)(z-2)(z+1)z}{[z - (\frac{1}{2} + j\frac{1}{2})][z - (\frac{1}{2} - j\frac{1}{2})][z - j\frac{1}{4}][z + j\frac{1}{4}]}$ realize the system in the direct form - I and direct form - II. (10 Marks)
- b. A Butterworth low pass filter has to meet the following specifications :
- Pass band ripple and edge frequency of 1dB, 100π rad/sec.
 - Stop band attenuation and edge frequency of 35 dB, 1000π rad/sec respectively at the sampling rate of 2000 samples/sec. Applying BLT technique, determine $H(z)$. (10 Marks)

Module-5

- 9 a. With a neat diagram, explain the Harvard architecture used in DSP processors. (07 Marks)
- b. Explain dedicated MAC computation in DSP processor with a block diagram. (05 Marks)
- c. Convert the following decimal numbers into the floating point representation :
- 0.640492×2^{-2}
 - -0.638454×2^5
- Use 4 bits to represent exponent and 12 bits for mantissa. (08 Marks)

OR

- 10 a. With a neat diagram, explain basic architecture of TMS320C54X family digital signal processors. (10 Marks)
- b. Describe the IEEE single precision floating point format used in DSP processors. (05 Marks)
- c. Find the signed Q - 15 representation for the decimal number 0.560123. (05 Marks)

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21EC42

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025 Digital Signal Processing

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Max. Marks: 100

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- c. The first five values of an 8 point DFT of real valued sequence are $(4, 1-j1, 0, 1+j2, 0)$. Find the remaining values of the DFT. (04 Marks)

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- b. Determine 4 point circular convolution between $x_1(n) = [1, 2, 2, 1]$ and $x_2(n) = [1, 1]$ using DFT and IDFT method. (10 Marks)

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- 3 a. State and prove Parseval's theorem in DFT. (06 Marks)
- b. Using overlap save method, compute $y(n)$ of a FIR filter with impulse response $h(n) = [3, 2, 1]$ to an input $x(n) = [2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1]$. Use only 8-point circular convolution. (08 Marks)
- c. For the sequences $x_1(n) = \cos\left(\frac{2\pi n}{N}\right)$ and $x_2(n) = \sin\left(\frac{2\pi n}{N}\right)$, $0 \leq n \leq N-1$, determine N point circular correlation of $x_1(n)$ and $x_2(n)$. (06 Marks)

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- b. Find the DFT of a sequence $x(n) = [1, 2, 3, 4, 4, 3, 2, 1]$ using radix 2 DIT – FFT algorithm. (10 Marks)

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- 5 a. Design a FIR filter with a desired frequency response
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- Draw the corresponding direct Form – I and lattice structure. (10 Marks)

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Module-4

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21EC43

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025 Circuits and Controls

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Briefly explain the types of sources in electric circuit. (05 Marks)
 b. Use mesh analysis to determine mesh currents in the circuit shown in Fig.Q.1(b).

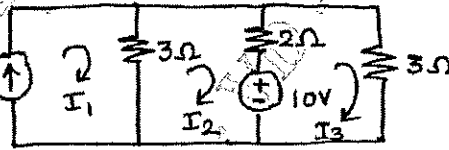


Fig.Q.1(b)

(10 Marks)

- c. Use Norton's theorem to determine current through branch 'b-e' in the circuit shown in Fig.Q.1(c).

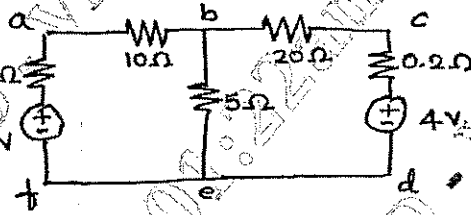


Fig.Q.1(c)

(05 Marks)

OR

- 2 a. State and explain Thevenin's theorem. (10 Marks)
 b. What should be the value of pure resistive load to be connected across the terminals a and b in the network shown in the Fig.Q.2(b), so that the maximum power is transferred to the load? What is the maximum power?

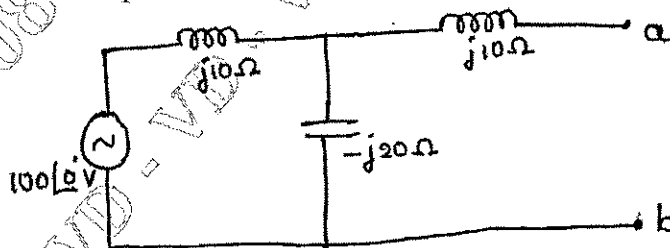


Fig.Q.2(b)

(10 Marks)

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Module-2

- 3 a. For the network of Fig.Q.3(a), determine z-parameters

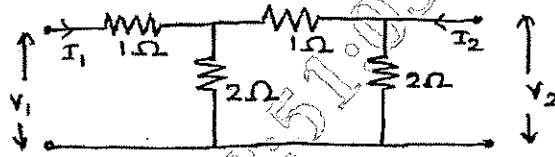


Fig.Q.3(a)

(08 Marks)

- b. Obtain Laplace transform of i) Unit step function ii) Unit impulse function. (04 Marks)
 c. State and prove initial and final value theorems. (08 Marks)

OR

- 4 a. Find the h-parameters of the network shown in Fig.Q.4(a).

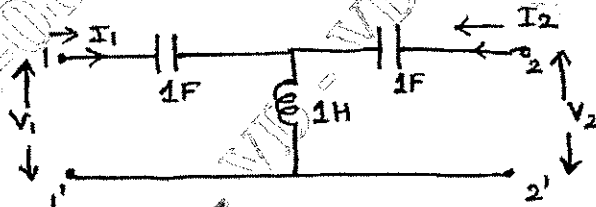


Fig.Q.4(a)

(10 Marks)

- b. In the series RL circuit shown in the Fig.Q.4(b), the source voltage is $v(t) = 50 \sin 250t$ V. Determine the resulting current if the switch is closed at $t = 0$.

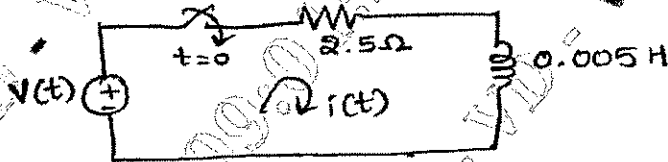


Fig.Q.4(b)

(10 Marks)

Module-3

- 5 a. Compare closed loop and open loop control systems. Give one example for each. (06 Marks)
 b. Find the transfer function $\frac{V_o(S)}{V_i(S)}$ for the system shown in Fig.Q.5(b) with buffer amplifier of gain K.

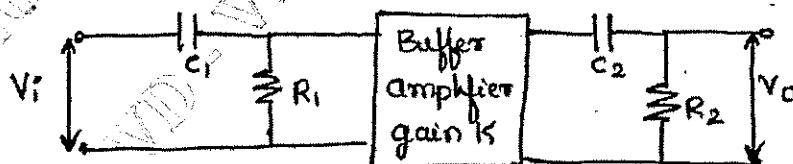


Fig.Q.5(b)

(06 Marks)

- c. Draw a block diagram for the electric circuit shown in Fig.Q.5(c) and evaluate the transfer function $\frac{E_o(S)}{E_i(S)}$.

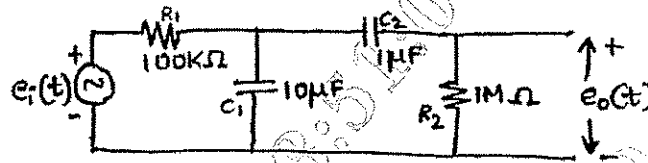


Fig.Q.5(c)

(08 Marks)

OR

- 6 a. What are the effects of negative feedback in control system? (05 Marks)
 b. Obtain the transfer function for the signal flow graph shown in Fig.Q.6(b) using Mason's gain formula.

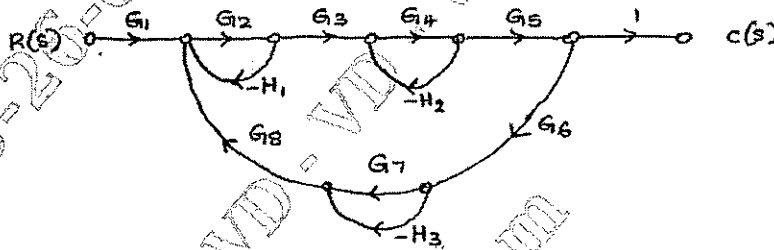


Fig.Q.6(b)

(10 Marks)

- c. Illustrate force to current analogy.

(05 Marks)

Module-4

- 7 a. Derive an expression for time response of an under damped second order system for a unit step input. (08 Marks)
 b. Check the stability of the system defined by the equation $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$ using R-H criterion. (06 Marks)
 c. Derive an expression for rise time (t_r) of an underdamped second order system. (06 Marks)

OR

- 8 a. For a unity feedback control system with $G(S) = \frac{64}{S(S+9.6)}$, write the output response to a unit step input. Determine :
 i) The response at $t = 0.1$ sec.
 ii) Maximum value of the response and time at which it occurs.
 iii) Settling time. (08 Marks)
 b. Explain Routh-Hurwitz criterion for stability of the system and mention its limitations. (04 Marks)
 c. A unity feedback system has $G(S) = \frac{K(S+13)}{S(S+3)(S+7)}$. Using Routh's criterion calculate the range of K for which the system is i) Stable ii) has its closed loop poles more negative than -1. (08 Marks)

Module-5

- 9 a. Sketch the complete root locus of the system having $G(S)H(S) = \frac{K}{S(S+1)(S+2)(S+3)}$ (10 Marks)
- b. Write short note on lead lag compensator. (04 Marks)
- c. Obtain the state model of the given electrical system as shown in Fig.Q.9(c). (06 Marks)

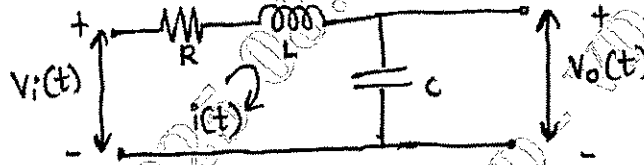


Fig.Q.9(c)

OR

- 10 a. A unity feedback control system has $G(S) = \frac{80}{S(S+2)(S+20)}$. Draw the Bode plot. Determine GM, PM, Wgc and Wpc and also comment on the stability. (10 Marks)
- b. A linear time invariant system is characterized by the homogeneous state equation:

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

Obtain the solution of homogeneous equation by assuming the initial state vector $X_0 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$.

(06 Marks)

- c. Explain any four rules for construction of root loci. (04 Marks)

OR

- 6 a. Explain the working of FH/MFSK transmitter and receiver with neat block diagram. (08 Marks)
- b. Explain CDMA based on IS-95, Forward link. (06 Marks)
- c. In a direct sequence, spread-spectrum modulation, it is required to have a jamming margin greater than 26dB. The ratio $\frac{E_b}{N_0}$ is set at 10. Determine the minimum processing gain and the minimum number of stages required to generate the maximum length sequence. (06 Marks)

Module-4

- 7 a. Define self information, average information, information rate and coding efficiency. (04 Marks)
- b. Refer the state diagram of the Markov source shown in Fig Q7(b). Find : i) probabilities of the state ii) Entropy of each state iii) Entropy of the source.

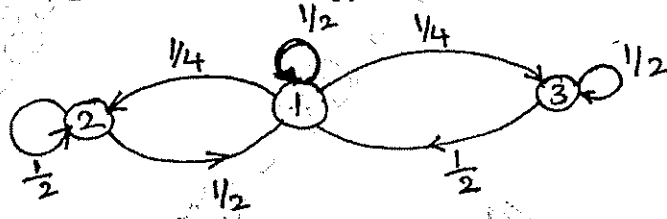


Fig Q7(b)

- c. For four symbols S_1, S_2, S_3 and S_4 having probabilities of occurrence given by 0.1, 0.2, 0.3 and 0.4. Construct a code using Shannon-Fane encoding algorithm and find the efficiency of coding. (06 Marks)

OR

- 8 a. A discrete memoryless source has an alphabet $x = \{x_1, x_2, x_3, x_4\}$. It is known that $P(x_1) = 0.4, P(x_2) = 0.3, P(x_3) = 0.2$ and $P(x_4) = 0.1$. Find $H(x)$ and show that $I(x_1, x_2, x_3, x_4) > H(x)$. (04 Marks)
- b. A source produces six symbols x_1, x_2, x_3, x_4, x_5 and x_6 with probabilities 0.3, 0.25, 0.20, 0.12, 0.08, 0.05. Construct Binary Huffman code. Find efficiency of coding and draw decision tree. (10 Marks)
- c. Explain in brief, the methods of controlling errors, types of errors and types of codes. (06 Marks)

Module-5

- 9 a. Consider a linear block code with $n = 6$ and $k = 3$. The check bits of this code are derived using the discrete relations given below : Take $D = [0 \ 0 \ 1]$
- $$C_4 = d_1 \oplus d_2$$
- $$C_5 = d_1 \oplus d_2 \oplus d_3$$
- $$C_6 = d_2 \oplus d_3$$
- Find Generator matrix, G
 - Find all the code-words of the linear block code
 - Find the error detecting and error correcting capabilities of the code. (08 Marks)
- b. Consider a single error correcting code (Hamming code) for a message block of size equal to 11. How many check bits are required? Find a parity check matrix for this code. (08 Marks)
- c. Draw the syndrome calculator circuit for a (7,4) single error correcting code. (04 Marks)

OR

- 10 a. Refer the code rate $r = \frac{1}{2}$ and constraint length $k = 3$ convolution encoder shown in Fig Q10(a) below. Find C for the message $m = \{1, 1, 0, 1\}$ using Time domain approach and transform domain approach.

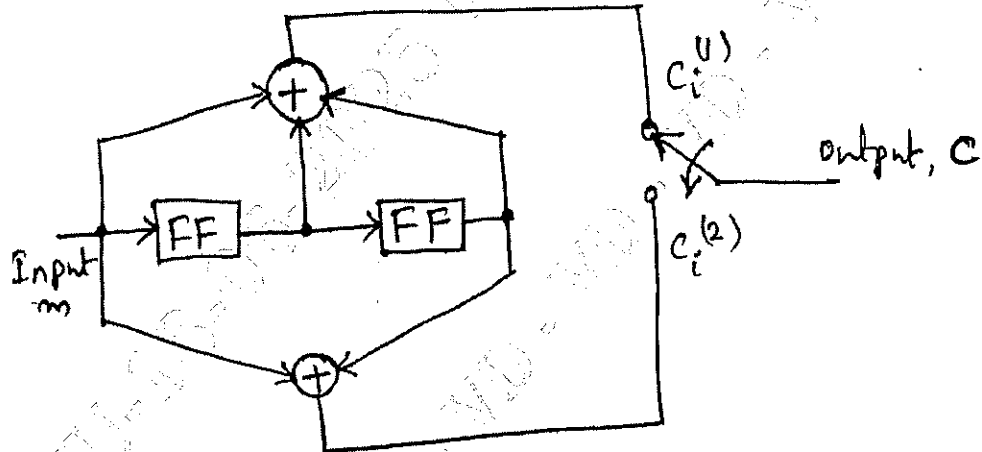


Fig Q10(a)

(10 Marks)

- b. For the convolution encoder shown in Fig Q10(b), draw the state diagram, tree diagram and find d_{free} .

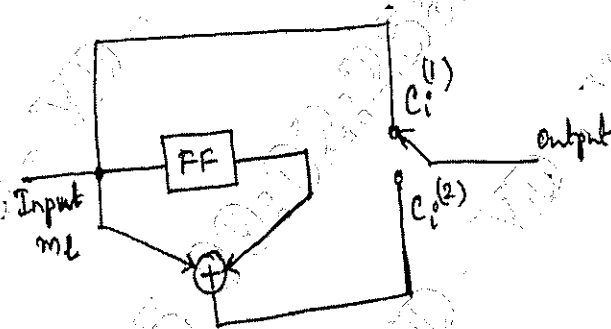


Fig Q10(b)

(10 Marks)

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21EC53

Fifth Semester B.E./B.Tech. Degree Examination, June/July 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. Explain the concept of packet switched and circuit switched network. (10 Marks)
b. What is physical topology? With illustration explain the various types of physical topology. (10 Marks)

OR

- 2 a. Explain the concept of encapsulation and decapsulation in protocol layering in the internet. (08 Marks)
b. With necessary illustration explain the different data flow techniques used for communication between two devices. (06 Marks)
c. Describe the LAN and WAN with neat sketches. (06 Marks)

Module-2

- 3 a. Describe the process of framing, flow control and error control in the Data Link Control (DLC) services. (10 Marks)
b. Explain the two kinds of services defined by the IEEE 802.11 wireless-LAN standard. (10 Marks)

OR

- 4 a. Explain the working of CSMA method used in MAC sublayer with a sketch of the space/time model of collision. (10 Marks)
b. With a suitable example network scenario. Explain the formation of a VLAN. What characteristics of VLAN are used for grouping workstations into a VLAN? (10 Marks)

Module-3

- 5 a. Explain the datagram approach and virtual circuit approach in forwarding the packets in the network layer with a neat sketch. (10 Marks)
b. With necessary illustration explain the concept of link state routing. (10 Marks)

OR

- 6 a. Write a note on the following services of the network layer.
i) Packetization
ii) Routing and forwarding
iii) Error control
iv) Flow control
v) Congestion control. (10 Marks)
b. Outline the three phases involved in data transfer in a connection oriented service. (10 Marks)

Module-4

- 7 a. Discuss the various services offered by TCP with neat illustration. (10 Marks)
b. Explain the working of Go-Back-N protocol. (10 Marks)

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

OR

- 8 a. Explain the features of TCP with suitable examples. (10 Marks)
b. Explain the working of the selective repeat protocol. (10 Marks)

Module-5

- 9 a. What is the use of File Transfer Protocol (FTP)? Explain control connection and data connection in FTP. (10 Marks)
b. Explain with example, the working of HTTP. (10 Marks)

OR

- 10 a. With suitable example explain the three phases of E-mail message transfer. (10 Marks)
b. What is meant by resolution in DNS system? Explain with neat diagrams, the two resolution processes used to resolve the domain names and addresses. (10 Marks)

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Fifth Semester B.E./B.Tech. Degree Examination, June/July 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. What do you mean by scalar and vector fields? Show the difference between two. (06 Marks)
- b. Given three points in Cartesian coordinate system as A(3, -2, 1), B(-3, -3, 5), C(2, 6, -4).
Find : i) The vector from A to C
ii) The unit vector from B to A
iii) The distance from B to C
iv) The vector from A to the midpoint of the straight line joining B to C. (08 Marks)
- c. State Coulomb's law of force between any two point charges and also in vector form. (06 Marks)

OR

- 2 a. A charge $Q_2 = 12 \text{ inc}$ is located in free space at $P_2 (-0.03, 0.01, 0.04)\text{m}$. Find the force on Q_2 due to Q_1 where $Q_1 = 110\mu\text{C}$ at $P_1(0.03, 0.08, -0.02)\text{m}$. (06 Marks)
- b. A volume charge density is expressed as $\rho_v = 10z^2 x \sin \pi y$. Find the total charge inside the volume $(-1 \leq x \leq 2)$, $(0 \leq y \leq 1)$, $(3 \leq z \leq 3.6)$. (06 Marks)
- c. Derive the expression for electric field intensity due to infinite line charge. (08 Marks)

Module-2

- 3 a. State and prove the Gauss's law. (06 Marks)
- b. Consider a coaxial cable with inner radius 'a' and outer radius 'b'. Derive the expression for flux density (\bar{D}) for the region $a < r < b$ using Gauss's law. (08 Marks)
- c. The flux density $\bar{D} = r/3 \bar{a}_r$, nc/m^2 is in the free space :
i) Find \bar{E} at $r = 0.2\text{m}$
ii) Find the electric flux leaving the sphere of $r = 0.2\text{m}$.
iii) Find the total charge within the sphere of $r = 0.3\text{m}$. (06 Marks)

OR

- 4 a. Derive Maxwell first equation as applied to the electro statics, using Gauss's law. State the divergence theorem using Maxwell's first equation. (06 Marks)
- b. Evaluate the both sides of divergence theorem for the field $\bar{D} = 2xy \bar{a}_x + x^2 \bar{a}_y$ c/m^2 and rectangular parallel piped formed by the planes $x = 0$ and $x = 1$, $y = 0$ and $y = 2$ and $z = 0$ and $z = 3$. (08 Marks)
- c. Derive the expression for the work done in moving a point charge in an electric field. (06 Marks)

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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) $V = r \cos \theta + \theta + \phi$. (06 Marks)
- b. Using the Laplace's equation, derive an expression for capacitance per unit length of a coaxial cable using the following boundary conditions. $V = V_0$ at $r = a$ and $V = 0$ at $r = b$, $b > a$. (08 Marks)
- c. State and explain Biot – Savart law applicable to magnetic field. (06 Marks)

OR

- 6 a. Derive the expression for a curl, applying Ampere's circuital law to an incremental surface element. (08 Marks)
- b. State and prove the Stoke's theorem. (06 Marks)
- c. What is scalar magnetic potential? Explain Laplace equations for scalar magnetic potential. (06 Marks)

Module-4

- 7 a. Define and explain the terms magnetic flux and magnetic flux density. Obtain the magnetic flux using magnetic flux density in coaxial cable. (08 Marks)
- b. In certain region, the magnetic flux density in a magnetic material with $\chi_m = 6$ is given and $\vec{B} = 0.005y^2 \vec{a}_x$ T. At $y = 0.4$ m, find the magnitude of: i) \vec{J} ii) \vec{J}_b iii) \vec{J}_T . (06 Marks)
- c. Discuss the boundary conditions for magnetic field based on the normal component of the \vec{B} and \vec{H} . (06 Marks)

OR

- 8 a. Derive an expression for the magnetic force between differential current elements. (06 Marks)
- b. A conductor of length 2.5m in $z = 0$ and $x = 0$ carries a current of 12A in $-\vec{a}_y$ direction. Calculate the uniform flux in the region, if the force on the conductor is 12×10^{-2} N in the direction specified by $\left[\frac{-\vec{a}_x + \vec{a}_z}{\sqrt{2}} \right]$. (08 Marks)
- c. State and explain Faraday's law of electromagnetic induction in integral and point form. (06 Marks)

Module-5

- 9 a. Write the Maxwell's equations in the integral form and explain the physical significance. (06 Marks)
- b. Two parallel conducting plates of area 0.05m^2 are separated by 2mm of lossy, dielectric for which $\epsilon_r = 8.3$ and $\sigma = 8 \times 10^{-4}$ S/m. given an applied voltage $V = 10 \sin 10^7 t$ V. Find total r.m.s current. (08 Marks)
- c. Do the fields $\vec{E} = E_m \sin x \sin t \vec{a}_y$ and $\vec{H} = \frac{E_m}{\mu_0} \cos x \cos t \vec{a}_z$ satisfy the Maxwell's equations. (06 Marks)

OR

- 10 a. Write short notes on Retarded potential. (06 Marks)
- b. Given $\vec{E} = E_0 z^2 e^{-t} \vec{a}_x$ in free space, determine if there exist a magnetic field such that both Faraday's law and Ampere's circuital law are satisfied simultaneously. (08 Marks)
- c. Discuss the propagation of uniform plane wave in good conductor. (06 Marks)

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21EC71

Seventh Semester B.E./B.Tech. Degree Examination, June/July 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. With a neat flow diagram, explain the steps involved in ASIC design. (10 Marks)
b. With neat diagram, explain the following :
i) Programmable logic devices
ii) Structured gate arrays. (10 Marks)

OR

- 2 a. With relevant diagram and equations, explain the conventional ripple carry adder. Mention its limitations. (10 Marks)
b. Explain the following:
i) I/O cells
ii) Cell compilers. (10 Marks)

Module-2

- 3 a. Explain the measurement of delay in floor planning. (10 Marks)
b. Briefly explain the following:
i) Goals and objectives of placement
ii) Timing driven placement method. (10 Marks)

OR

- 4 a. Explain physical design flow with respect to placement. (10 Marks)
b. Explain global routing between blocks. (10 Marks)

Module-3

- 5 a. Explain the verification process with an example. (10 Marks)
b. Discuss direct testing method and its limitations in system verilog. (10 Marks)

OR

- 6 a. Describe fixed size arrays with an example. (08 Marks)
b. Explain dynamic arrays with sample code. (06 Marks)
c. Explain array reduction methods and array locator methods. (06 Marks)

Module-4

- 7 a. Explain tasks, functions and void functions in system verilog. (10 Marks)
b. Explain time values in system verilog. (10 Marks)

OR

- 8 a. List the interface tradeoffs in system verilog. (08 Marks)
b. Explain system verilog assertions. (12 Marks)

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Module-5

- 9 a. What is Randomization? Explain all design inputs in detail for randomization. (10 Marks)
- b. Explain in detail about iterative and array constraints. (10 Marks)

OR

- 10 a. Describe various functional coverage strategies in detail. (10 Marks)
- b. Discuss various carriage options with an example. (10 Marks)

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CBCS SCHEME

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21EC72

Seventh Semester B.E./B.Tech. Degree Examination, June/July 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. Explain the basic three configurations of optical fibers. (10 Marks)
b. Illustrate the relationship between acceptance angle and refractive indices according to Ray theory. (10 Marks)

OR

- 2 a. A continuous 12 km long optical fiber has a loss of 1.5 dB/km.
i) What is the minimum optical power level that must be launched into the fiber to maintain an optical power level of $0.3 \mu\text{W}$ at the receiving end.
ii) What is the required input power if the fiber has a loss of 2.5 dB/km? (10 Marks)
b. Explain bending losses. (10 Marks)

Module-2

- 3 a. What are avalanche photodiodes and briefly explain RAPD (Reach – through avalanche photo diode)? (10 Marks)
b. Derive the equations for frequency spacing and wavelength spacing for the laser diode. (10 Marks)

OR

- 4 a. Explain Etalon theory. (10 Marks)
b. Explain diffraction grating. (10 Marks)

Module-3

- 5 a. Compare diffraction and scattering. (10 Marks)
b. Consider a base-station transmitter operating at 900 MHz carrier frequency. For a mobile moving at a speed of 72 km/h, calculate the received carrier frequency if the mobile is moving.
i) Directly away from the base-station transmitter.
ii) Directly towards the base-station transmitter.
iii) In a direction which is 60° to the direction of arrival of the transmitted signal.
iv) In a direction perpendicular to the direction of arrival of the transmitted signal. (10 Marks)

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OR

- 6 a. i) Assume a cellular system of 32 cells with a cell radius of 1.6 km, a total spectrum allocation that supports 336 traffic channels and a reuse pattern of 7. Calculate the total service area covered with this configuration, the number of channels per cell and a total system capacity. Assume regular hexagonal cellular topology.
 ii) Let the size of cell be reduced to the extent that the same area as covered in (i) with 128 cells. Find the radius of the new cell and new system capacity. (10 Marks)
- b. Illustrate and prove that for a regular hexagonal geometry, the frequency reuse ratio is given by the relationship $q = \sqrt{3K}$ where $K = i^2 + j^2 + i \times j$; i and j being the shift parameters. (10 Marks)

Module-4

- 7 a. List out any ten salient features of TDMA technique. (10 Marks)
 b. What is SDMA? Give some examples of smart antennas and some advantages of smart antennas. (10 Marks)

OR

- 8 a. Illustrate the concept of hybrid TDMA/FDMA technique commonly used in 2G digital cellular systems such as IS 136 and GSM cellular systems. (10 Marks)
 b. What are the steps involved for landline (PSTN) to mobile (cellular) call in a cellular telephone system? (10 Marks)

Module-5

- 9 a. i) Show that the 3-dB bandwidth for a Gaussian LPF used to produce $B \times T_b = 0.3$ GMSK modulation in GSM standard is 81.3 kHz. The channel data rate is 270.833 kbps.
 ii) The channel data rate is 270.833 kbps in GSM standard that is 40% (say) of the theoretical maximum data rate that can be supported in a 200 kHz channel bandwidth. Calculate the corresponding theoretical S/N required. (10 Marks)
- b. What are GSM traffic channels? Describe the two types of TCH channels. (10 Marks)

OR

- 10 a. Describe GSM hand-OFF procedures briefly. (10 Marks)
 b. i) What is frequency hopping in GSM?
 ii) In Europe, GSM uses the frequency band of 890 to 915 MHz for uplink transmission and the frequency band of 925 to 960 MHz for downlink transmission. Determine the maximum frequency hop from one frame to the next for uplink transmission and downlink transmission. Express it as a percentage of the mean carrier frequency. (10 Marks)

CBCS SCHEME

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21EC732

Seventh Semester B.E./B.Tech. Degree Examination, June/July 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. Explain fundamental steps in digital image processing with block diagram. (10 Marks)
b. Explain the image acquisition using sensor strips and sensor arrays. (10 Marks)

OR

- 2 a. Explain the process of image sampling and quantization. (07 Marks)
b. How image is formed in eye? Explain visual perception of eye. (06 Marks)
c. For $V = \{0, 1\}$, compute the length of the shortest 4, 8 and m paths between p and q in the following image. If a particular path does not exist between these two points, explain why?

Repeat for $V = \{1, 2\}$.

3 1 2 1 (q)

2 2 0 2

1 2 1 1

(p) 1 0 1 2

(07 Marks)

Module-2

- 3 a. Explain the two-dimensional discrete Fourier transform (2D-DFT) and also state the properties of 2D-DFT. (10 Marks)
b. Explain the following properties of unitary transforms.
i) Energy Conservation and Rotation
ii) Energy Compaction and Variances
iii) Transform coefficients
iv) Decorrelation. (10 Marks)

OR

- 4 a. Define discrete cosine transformation and its inverse transformation. Also state the properties of cosine transform. (10 Marks)
b. For the 2×2 transform A and the image U

$$A = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}, U = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

Calculate the transformed image V and the basis images. (06 Marks)

- c. Briefly explain separable Unitary Transforms. (04 Marks)

Module-3

- 5 a. Explain the following intensity transformation functions (12 Marks)
i) Image Negative
ii) Log - transformation
iii) Power law transformation

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- b. Write the original histogram, transformation function and equalized histogram for the 3 bit, 64×64 size image whose information is given in below table

r_k	0	1	2	3	4	5	6	7
n_k	790	1023	850	656	329	245	122	81

(08 Marks)

OR

- 6 a. What do you mean by histogram processing? Explain histogram equalization. (10 Marks)
 b. Explain image sharpening in spatial domain using second order Laplacian derivative. (06 Marks)
 c. Explain the concept of Bit plane slicing. (04 Marks)

Module-4

- 7 a. Explain Smoothing of image in frequency domain using
 i) Ideal low pass filter
 ii) Butterworth low pass filter
 iii) Gaussian low pass filter (10 Marks)
 b. Explain Homomorphic filters for image enhancement with necessary equations block diagram and transfer function. (10 Marks)

OR

- 8 a. Explain the following color models:
 i) RGB color model
 ii) HSI model (10 Marks)
 b. What is pseudo color image processing? Explain intensity slicing as applied to pseudo color image processing. (10 Marks)

Module-5

- 9 a. Explain adaptive local noise reduction filter and adaptive median filter with the algorithm. (08 Marks)
 b. Explain Weiner filtering with necessary mathematical equations. (06 Marks)
 c. Explain the following mean filters used for image restoration
 i) Arithmetic mean
 ii) Geometric mean
 iii) Harmonic mean (06 Marks)

OR

- 10 a. With necessary diagram and relevant equations, explain any four noise probability density functions. (10 Marks)
 b. Explain with necessary expression the periodic noise reduction by frequency domain filtering. (10 Marks)

CBCS SCHEME

21EC742

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Seventh Semester B.E./B.Tech. Degree Examination, June/July 2025 Network Security

Max. Marks: 100

Time: 3 hrs.

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

Module-1

- 1 a. Discuss the principles of security in detail each with an example. (10 Marks)
b. Explain Passive and Active attacks with a suitable diagram. (10 Marks)

OR

- 2 a. With a neat diagram, explain the model for Network security. (10 Marks)
b. Describe the terms Viruses, Worms and Cookies. (10 Marks)

Module-2

- 3 a. Draw the Secure Socket Layer Protocol stack and describe the working in detail. (10 Marks)
b. Discuss the four stages of Handshake Protocol with a diagram. (10 Marks)

OR

- 4 a. Draw and explain Secure Shell (SSH) Protocol. (10 Marks)
b. What is the importance of HTTPS? Explain the connection initiation and closure of HTTPS. (10 Marks)

Module-3

- 5 a. Explain IP Security Architecture with a diagram. (10 Marks)
b. Explain in brief Transport and Tunnel mode. (10 Marks)

OR

- 6 a. With a flow chart, explain processing for outbound and inbound packets. (10 Marks)
b. Explain ESP packet format in detail. (10 Marks)

Module-4

- 7 a. Name the classes of intruders. Describe the intruder behavior pattern. (10 Marks)
b. Define Intrusion detection. Explain rule based detection. (10 Marks)

OR

- 8 a. Describe the four phases of virus. (10 Marks)
b. Explain in brief Virus counter measures. (10 Marks)

Module-5

- 9 a. List and explain firewall characteristics in brief. (10 Marks)
b. Explain different types of Firewall. (10 Marks)

OR

- 10 a. Explain in detail various firewall configuration. (10 Marks)
b. With a suitable diagram, explain distributed firewall. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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CBCS SCHEME

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Seventh Semester B.E./B.Tech. Degree Examination, June/July 2025 E-waste Management

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define E-waste. Explain life cycle of an e-product with a neat block diagram. (10 Marks)
b. Explain 3 sets of legislation/regulator frameworks existing for management of E-waste. (10 Marks)

OR

- 2 a. Illustrate with appropriate block diagram how to tackle E-waste at global level. (10 Marks)
b. Explain the various opportunities and challenges of E-waste management in India. (10 Marks)

Module-2

- 3 a. List and discuss the various considerations for successful implementation of EPR. (10 Marks)
b. Explain the mapping of environmental impacts of a cell phone. (10 Marks)

OR

- 4 a. Discuss the experiences of EPR and take-back campaign by Nokia in 2009 and 2012. (10 Marks)
b. Explain the three tier treatment processes for recycling E-waste. (10 Marks)

Module-3

- 5 a. Explain with a neat diagram the linear and circular economy. (10 Marks)
b. Discuss the performance of EPR and CPCB as regulatory mechanisms. (10 Marks)

OR

- 6 a. Discuss urban mining and its significance in circular economy. (10 Marks)
b. Discuss E-waste Management Rules, 2016 and list out the salient changes compared to Rules, 2011. (10 Marks)

Module-4

- 7 a. Illustrate with a neat block diagram and explain the policy issues for E-waste management before 2010. (10 Marks)
b. Explain the ENVIS and PIAP by Government of India to create awareness about E-waste Management. (10 Marks)

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

OR

- 8 a. Discuss the various initiatives by Government agencies and industry actors past 2012 for E-waste management. (10 Marks)
- b. Explain the gap analysis in E-waste management representing multistakeholder views. (10 Marks)

Module-5

- 9 a. Explain the four domains of E-waste management based on E-waste management thinking matrix. (10 Marks)
- b. Explain the recycling and disposal of residues related issues. (10 Marks)

OR

- 10 a. Explain the various economic concerns associated with E-waste management. (10 Marks)
- b. Discuss the legal compliance by producer, through the PRO. (10 Marks)

CBCS SCHEME

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21EC42

Fourth Semester B.E./B.Tech. Degree Examination, June/July 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. Find the 16 point DFT of a signal

$$x(n) = \begin{cases} \frac{1}{2} & n \leq 0 \\ 1 & 1 \leq n \leq 15 \end{cases}$$

(08 Marks)

- b. With neat diagram, explain frequency domain sampling and reconstruction of discrete time signals. (08 Marks)
- c. The first five values of an 8 point DFT of real valued sequence are $(4, 1-j1, 0, 1+j2, 0)$. Find the remaining values of the DFT. (04 Marks)

OR

- 2 a. Determine 8 point DFT of $x(n) = [1, 1, 1, 1, 0, 0, 0, 0]$. (10 Marks)
- b. Determine 4 point circular convolution between $x_1(n) = [1, 2, 2, 1]$ and $x_2(n) = [1, 1]$ using DFT and IDFT method. (10 Marks)

Module-2

- 3 a. State and prove Parseval's theorem in DFT. (06 Marks)
- b. Using overlap save method, compute $y(n)$ of a FIR filter with impulse response $h(n) = [3, 2, 1]$ to an input $x(n) = [2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1]$. Use only 8-point circular convolution. (08 Marks)
- c. For the sequences $x_1(n) = \cos\left(\frac{2\pi n}{N}\right)$ and $x_2(n) = \sin\left(\frac{2\pi n}{N}\right)$, $0 \leq n \leq N-1$, determine N point circular correlation of $x_1(n)$ and $x_2(n)$. (06 Marks)

OR

- 4 a. Using overlap add method, compute $y(n)$ of a FIR filter with impulse response $h(n) = [1, 2, 1]$ to an input sequence $x(n) = [1, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 2, 1]$, use only 6-point circular convolution. (10 Marks)
- b. Find the DFT of a sequence $x(n) = [1, 2, 3, 4, 4, 3, 2, 1]$ using radix 2 DIT - FFT algorithm. (10 Marks)

Module-3

- 5 a. Design a FIR filter with a desired frequency response

$$H_d(e^{jw}) = \begin{cases} e^{-j3w}, & -\frac{3\pi}{4} \leq w \leq \frac{3\pi}{4} \\ 0; & \frac{3\pi}{4} < |w| < \pi \end{cases}$$

Also obtain the frequency response. (10 Marks)

- b. A FIR filter is given by difference equation

$$y(n] = x(n) + \frac{2}{5}x(n-1) + \frac{3}{4}x(n-2) + \frac{1}{3}x(n-3)$$

Draw the corresponding direct Form - I and lattice structure. (10 Marks)

OR

- 6 a. Given $H(z) = (1 + 0.6z^{-1})^5$. Realize in direct form and cascade of first and second order sections. (10 Marks)
- b. Determine filter coefficients $h(n)$ of a FIR filter with a desired frequency response. (10 Marks)

$$H_d(\omega) = \begin{cases} e^{-2j\omega} & -\pi/4 \leq \omega \leq \pi/4 \\ 0 & \pi/4 \leq |\omega| \leq \pi \end{cases} \text{ use Hamming window.} \quad (10 \text{ Marks})$$

Module-4

- 7 a. Derive the expression for the order of Butterworth filter. (06 Marks)
- b. The system function of the analog filter is given as $H_a(S) = \frac{S+0.1}{(S+0.1)^2+16}$. Obtain the system function of the digital filter using bilinear transformation. Assume $T=2$ seconds. (06 Marks)
- c. Design a digital Butterworth filter with a maximum pass band attenuation 3.01 dB at pass band edge frequency 500Hz and stop-band attenuation of 15 dB at stop band edge frequency 750 Hz. Sampling rate of 2 KHz. (08 Marks)

OR

- 8 a. A system is specified by its transfer function $H(z) = \frac{(z-1)(z-2)(z+1)z}{[z-(\frac{1}{2}+j\frac{1}{2})][z-(\frac{1}{2}-j\frac{1}{2})][z-j\frac{1}{4}][z+j\frac{1}{4}]}$ realize the system in the direct form - I and direct form - II. (10 Marks)
- b. A Butterworth low pass filter has to meet the following specifications :
 i) Pass band ripple and edge frequency of 1dB, 100π rad/sec.
 ii) Stop band attenuation and edge frequency of 35 dB, 1000π rad/sec respectively at the sampling rate of 2000 samples/sec. Applying BLT technique, determine $H(z)$. (10 Marks)

Module-5

- 9 a. With a neat diagram, explain the Harvard architecture used in DSP processors. (07 Marks)
- b. Explain dedicated MAC computation in DSP processor with a block diagram. (05 Marks)
- c. Convert the following decimal numbers into the floating point representation :
 i) 0.640492×2^{-2} ii) -0.638454×2^5
 Use 4 bits to represent exponent and 12 - bits for mantissa. (08 Marks)

OR

- 10 a. With a neat diagram, explain basic architecture of TMS320C54X family digital signal processors. (10 Marks)
- b. Describe the IEEE single precision floating point format used in DSP processors. (05 Marks)
- c. Find the signed Q - 15 representation for the decimal number 0.560123. (05 Marks)

CBCS SCHEME

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21EC43

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025 Circuits and Controls

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Briefly explain the types of sources in electric circuit. (05 Marks)
- b. Use mesh analysis to determine mesh currents in the circuit shown in Fig.Q.1(b).

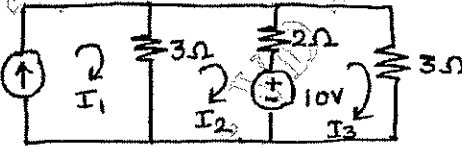


Fig.Q.1(b)

(10 Marks)

- c. Use Norton's theorem to determine current through branch 'b-e' in the circuit shown in Fig.Q.1(c).

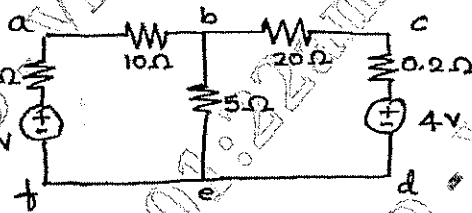


Fig.Q.1(c)

(05 Marks)

OR

- 2 a. State and explain Thevenin's theorem. (10 Marks)
- b. What should be the value of pure resistive load to be connected across the terminals a and b in the network shown in the Fig.Q.2(b), so that the maximum power is transferred to the load? What is the maximum power?

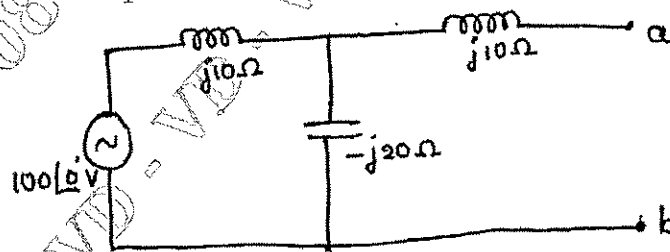


Fig.Q.2(b)

(10 Marks)

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

Module-2

- 3 a. For the network of Fig.Q.3(a), determine z-parameters

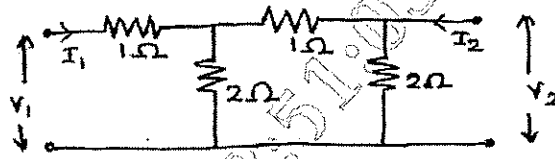


Fig.Q.3(a)

(08 Marks)

- b. Obtain Laplace transform of i) Unit step function ii) Unit impulse function. (04 Marks)
 c. State and prove initial and final value theorems. (08 Marks)

OR

- 4 a. Find the h-parameters of the network shown in Fig.Q.4(a).

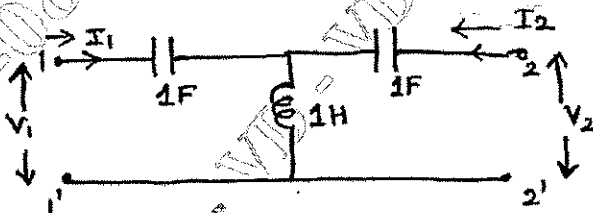


Fig.Q.4(a)

(10 Marks)

- b. In the series RL circuit shown in the Fig.Q.4(b), the source voltage is $v(t) = 50 \sin 250t$ V. Determine the resulting current if the switch is closed at $t = 0$.

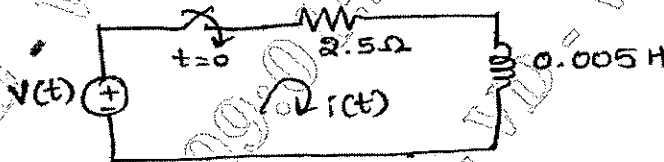


Fig.Q.4(b)

(10 Marks)

Module-3

- 5 a. Compare closed loop and open loop control systems. Give one example for each. (06 Marks)
 b. Find the transfer function $\frac{V_o(S)}{V_i(S)}$ for the system shown in Fig.Q.5(b) with buffer amplifier of gain K.

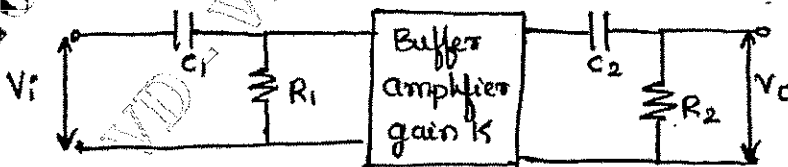


Fig.Q.5(b)

(06 Marks)

- c. Draw a block diagram for the electric circuit shown in Fig.Q.5(c) and evaluate the transfer function $\frac{E_o(S)}{E_i(S)}$.

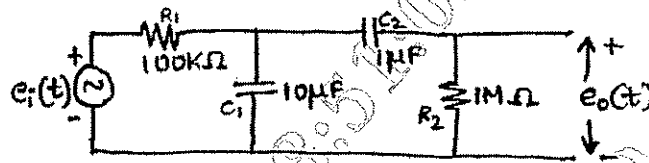


Fig.Q.5(c)

(08 Marks)

OR

- 6 a. What are the effects of negative feedback in control system? (05 Marks)
 b. Obtain the transfer function for the signal flow graph shown in Fig.Q.6(b) using Mason's gain formula.

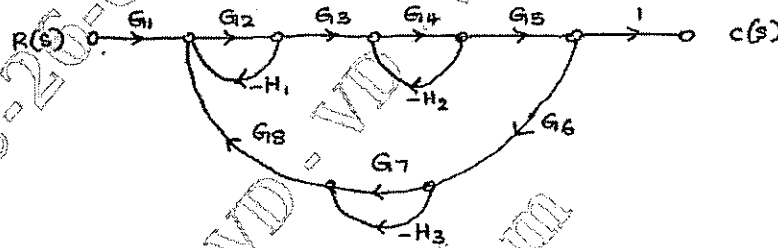


Fig.Q.6(b)

(10 Marks)

- c. Illustrate force to current analogy.

(05 Marks)

Module-4

- 7 a. Derive an expression for time response of an under damped second order system for a unit step input. (08 Marks)
 b. Check the stability of the system defined by the equation $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$ using R-H criterion. (06 Marks)
 c. Derive an expression for rise time (t_r) of an underdamped second order system. (06 Marks)

OR

- 8 a. For a unity feedback control system with $G(S) = \frac{64}{S(S+9.6)}$, write the output response to a unit step input. Determine :
 i) The response at $t = 0.1$ sec.
 ii) Maximum value of the response and time at which it occurs.
 iii) Settling time. (08 Marks)
 b. Explain Routh-Hurwitz criterion for stability of the system and mention its limitations. (04 Marks)
 c. A unity feedback system has $G(S) = \frac{K(S+13)}{S(S+3)(S+7)}$. Using Routh's criterion calculate the range of K for which the system is i) Stable ii) has its closed loop poles more negative than -1. (08 Marks)

Module-5

- 9 a. Sketch the complete root locus of the system having $G(S)H(S) = \frac{K}{S(S+1)(S+2)(S+3)}$ (10 Marks)
- b. Write short note on lead lag compensator. (04 Marks)
- c. Obtain the state model of the given electrical system as shown in Fig.Q.9(c). (06 Marks)

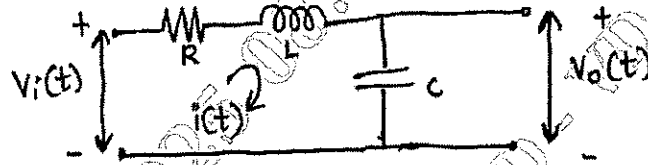


Fig.Q.9(c)

OR

- 10 a. A unity feedback control system has $G(S) = \frac{80}{S(S+2)(S+20)}$. Draw the Bode plot. Determine GM, PM, Wgc and Wpc and also comment on the stability. (10 Marks)
- b. A linear time invariant system is characterized by the homogeneous state equation:

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

- Obtain the solution of homogeneous equation by assuming the initial state vector $X_0 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$. (06 Marks)
- c. Explain any four rules for construction of root loci. (04 Marks)

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21EC62

Sixth Semester B.E./B.Tech. Degree Examination, June/July 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. Explain the operating principle of Gunn-diode with neat energy band diagram and I-V-Characteristics. (08 Marks)
- b. A Telephone Line has $R = 6 \Omega/\text{km}$, $L = 2.2 \text{ mH}/\text{km}$, $C = 0.005 \text{ mF}/\text{km}$ and $G = 0.05 \text{ mho}/\text{km}$. Determine Z_0 , α , β at 1 KHz frequency and also find phase – velocity V_p (m=milli). (08 Marks)
- c. What are standing waves? Obtain expressions for VSWR in terms of reflection coefficient(P). (04 Marks)

OR

- 2 a. Derive the transmission line equations in voltage and current forms. (08 Marks)
- b. A 50Ω lossless line connects a matched signal of 100 KHz to a load of 100Ω . The load power is 100 mW. Calculate:
 - i) Voltage reflection coefficient (P)
 - ii) VSWR of the load
 - iii) Position of first V_{\min} and V_{\max}
 - iv) Imp at V_{\min} and V_{\max} and value of V_{\min} and V_{\max} . (08 Marks)
- c. Explain briefly single stub impedance matching technique. (04 Marks)

Module-2

- 3 a. Derive the S-matrix representation of a multiport network. (08 Marks)
- b. What is circulator? Explain the operating principle of 4 port circulator. (06 Marks)
- c. What are attenuators? Explain its different types briefly. (06 Marks)

OR

- 4 a. Derive the S-matrix for Magic –T. (08 Marks)
- b. What are waveguide Tees? Explain briefly each type. (08 Marks)
- c. Write a note on Faraday's rotation Isolator. (04 Marks)

Module-3

- 5 a. Explain the construction of micro-strip line. (05 Marks)
- b. Discuss the different types of losses occurs in micro-strip lines. (05 Marks)
- c. A micro-strip line composed of zero – thickness copper conductors on a substrate having $\epsilon_r = 8.4$, $\tan \delta = 0.0005$ and thickness 2.4 mm. If the line width is 1 mm and operated at 10 GHz, calculate:
 - i) Characteristics impedance Z_0
 - ii) Attenuation due to conductor loss and dielectric loss. (10 Marks)

OR

- 6 a. Define following parameters with respect to antenna:
 i) Radiation pattern
 ii) Radiation intensity
 iii) Beam Area (Ω_A). (08 Marks)
- b. Explain the radio-communication link and derive Friis transmission formula. (06 Marks)
- c. An antenna has normalized field pattern given by $E_n = \cos^3 \theta$; where θ is polar angle in spherical co-ordinates and it varies from 0 to π . Find the HPBW and directivity. (06 Marks)

Module-4

- 7 a. Derive an expression for radiation resistance of a short-dipole antenna. (08 Marks)
- b. Explain and derive the array of two isotropic point sources of same amplitudes and phase. (08 Marks)
- c. Explain the principle of pattern multiplication. (04 Marks)

OR

- 8 a. Explain with neat diagram linear array of n-isotropic point sources of equal amplitude and spacing. (10 Marks)
- b. Write a note on short dipole antenna. (05 Marks)
- c. Write short notes on Thin linear antenna. (05 Marks)

Module-5

- 9 a. Derive an expression for radiation resistance of a small-loop antenna. (10 Marks)
- b. Explain the rectangular horn antenna and its basic types. (10 Marks)

OR

- 10 a. Explain the operational modes of a Helicost antenna. (10 Marks)
- b. Explain Yagi-Uda array with the help of neat diagram. (10 Marks)

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21EC63

Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025 VLSI Design and Testing

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Describe the working of n – type MOSFET with neat diagrams. Derive the equations for drain current. (10 Marks)
- b. Realize the CMOS gate for the following function :
 $Y = (A + B)C + DE$ (03 Marks)
- c. Implement 2 : 1 multiplexes using transmission gate and explain its operation with necessary timing diagram. (07 Marks)

OR

- 2 a. Explain the operation of CMOS inverter with help of transfer characteristics. Explain various region of operation. (07 Marks)
- b. With necessary circuit diagram operation of tristate inverter, and realize 2 : 1 multiplexer with tristate inverter. (10 Marks)
- c. Realize 3 i/p NOR gate using CMOS logic. (03 Marks)

Module-2

- 3 a. Explain the steps fabrication of CMOS n – well process with neat sketches. (10 Marks)
- b. What is λ – based design rules? Write design rules for following layers :
i) Polysilicon ii) Metal iii) n_+ & P_+ diffusion iv) N well. (06 Marks)
- c. Draw the layout diagram for 2 input NAND Gate. (04 Marks)

OR

- 4 a. Define term “Logical effort”. Describe the estimation of logic effort by using example. (06 Marks)
- b. Estimate parasitic delay of 2 input NAND gate with PMOS width of 2 NMOS width of 2. (04 Marks)
- c. Draw stick diagram for 3 input NAND gate and estimate the number of tracks and dimensions. (10 Marks)

Module-3

- 5 a. Write the classification of semiconductor memories and explain typical memory organization of RAM memory with neat diagram. (10 Marks)
- b. Explain operation of full CMOS SRAM cell with necessary topology. (10 Marks)

OR

- 6 a. Differentiate between DRAM and SRAM. (04 Marks)
- b. Explain the operation of 4×4 NOR based ROM array with necessary circuit diagram. (06 Marks)
- c. Write short notes on :
i) Flash memory cell
ii) Ferro electric RAM. (10 Marks)

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

Module-4

- 7 a. Describe the different types of bridging faults with example. (06 Marks)
 b. Describe temporary faults in VLSI. (04 Marks)
 c. For the logic model shown below in Fig. Q7(c), find the Boolean difference with respect to X_2 . (10 Marks)

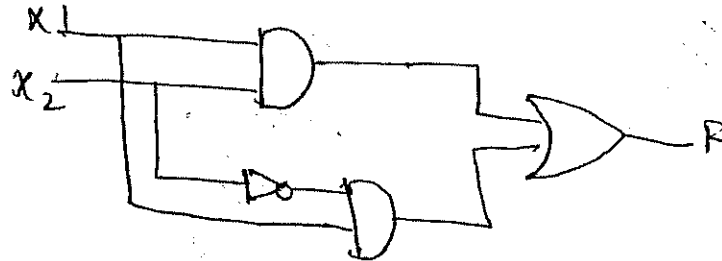


Fig. Q7(c)

OR

- 8 a. Describe the following term of D algorithm with example.
 i) Singular cover ii) Propagation and D – cubes
 iii) Primitive D – cubes and fault. (10 Marks)
 b. What is fault diagnosis? Explain one dimensional path sensitization technique for combinational circuits with an example. (10 Marks)

Module-5

- 9 a. Define following with example :
 i) Controllability ii) Observability. (08 Marks)
 b. Describe any two Adhoc design rules for improving testability. (06 Marks)
 c. For state table – 1 , find i) Homing sequence ii) Distinguish sequence and
 iii) Response of machine in homing sequence. (06 Marks)

P - state	I/P	
	X = 0	X = 1
A	B . 0	D . 0
B	A . 0	B . 0
C	D . 1	A . 0
D	D . 1	C . 0

OR

- 10 a. List LSSD design rules. (10 Marks)
 b. Explain list generation based on functional fault models. (10 Marks)

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21EC643

Sixth Semester B.E./B.Tech. Degree Examination, June/July 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 different types of 'If' statements supported by Python. Explain each type with appropriate example program and flow chart. (08 Marks)
- b. Demonstrate the use of 'break' and 'continue' with while loop with suitable example in python. (06 Marks)
- c. Write the syntax, description of any 3 built in functions that are used in python. Give example for each. (06 Marks)

OR

- 2 a. Write a python program to create a function called 'collatz()' which reads a parameter named 'number'. If the number is even, the function should return number //2 and if the number is odd then it should return 3 * number + 1. Display the returned value. This function should be called continuously until the function returns a value 1. (08 Marks)
- b. Define scope of the variables. Illustrate with suitable example, the local and global scope variables used in python. (08 Marks)
- c. List the naming rules to be followed in python for identifiers. (04 Marks)

Module-2

- 3 a. What is list? Explain the concept of slicing and indexing related with lists with proper examples. (06 Marks)
- b. Write a python program to create and fill the list with 10 integers collected from user at run time. Also count the even numbers and odd numbers of this list and display the counts. (06 Marks)
- c. Explain the pyperclip.copy() and paste() functions with example program. (08 Marks)

OR

- 4 a. Explain any 4 string methods in python with example code snippets. (08 Marks)
- b. Compare dictionary with list. Write a python program to accept a sentence and find the total number of words and display. Create a dictionary named 'd' that collects the number of upper case letters, lower case letter and digits used in the given sentence. (08 Marks)
- c. Differentiate get() and setdefault() methods with appropriate code snippets. Mention their outputs. (04 Marks)

Module-3

- 5 a. What is regular expressions? Explain the process of finding patterns of text with regular expression and associated methods in python with an example. (07 Marks)
- b. Describe the following with suitable python code snippet:
 (i) Greedy and non-greedy pattern matching
 (ii) findall() method of regex object (07 Marks)
- c. Explain saving of variables using shelve module. (06 Marks)

OR

- 6 a. Explain the file reading, writing process with suitable python program. (07 Marks)
- b. Explain the following OS related methods with suitable code snippet:
 (i) getcwd() (ii) chdir() (iii) listdir() (06 Marks)
- c. List and explain shorthand code for common character classes. Illustrate how do you define your own character class. (07 Marks)

Module-4

- 7 a. Write a python program to define a class named 'rectangle' with the following attributes height, width and a member function named 'grow_rectangle'. The grow_rectangle takes a rectangle object and two numbers dheight and dwidth as arguments and returns the modified height and width. Display the height and width of rectangle before and after. (06 Marks)
- b. What is class? How do you define a class in python? How to instantiate the class and access its members? (07 Marks)
- c. Explain the operator overloading with example code. (07 Marks)

OR

- 8 a. Explain __init__ and __str__ methods. (06 Marks)
- b. With example program, explain the type based dispatch concept. (07 Marks)
- c. What is pure function? Illustrate with an example python program. (07 Marks)

Module-5

- 9 a. Write a python program to retrieve the image over HTTP and save the image to a file named 'stuff.jpg'. (08 Marks)
- b. What is JSON? Explain the json module of python. Demonstrate with a python program. (06 Marks)
- c. List and explain the three different kinds of keys used in data base model. (06 Marks)

OR

- 10 a. Explain in detail how to parse HTML with the BeautifulSoup. (07 Marks)
- b. Write a simple python application that parses some XML and extracts some data elements from XML. (06 Marks)
- c. What is a database? Write a code to create a table named 'Tracks' with two columns in the database named 'title' and 'plays'. (07 Marks)

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21EC652

Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025

Microcontrollers

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Bring out the difference between microprocessor and microcontroller. (05 Marks)
- b. With a neat architecture diagram explain the architectural features of 8051 microcontroller. (10 Marks)
- c. Explain the following terms :
 - i) Stack and Stack pointer
 - ii) Data pointer and program counter. (05 Marks)

OR

- 2 a. Explain the bit contents of Program Status Word (PSW). (06 Marks)
- b. Write circuit diagram of Port 1, explain input and output operations in 8051 using Port 1. (08 Marks)
- c. Explain the internal RAM organization in 8051. (06 Marks)

Module-2

- 3 a. Explain five different addressing mode with an example. (10 Marks)
- b. Write an ALP to add 2-16 bit numbers 3CE7h and 368Bh. (05 Marks)
- c. Explain swap and rotate instruction with an example. (05 Marks)

OR

- 4 a. List and explain byte level logical operation (any five). (06 Marks)
- b. Write an ALP to convert a packed BCD number to ASCII number. Store result in R5 and R6 respectively. (08 Marks)
- c. Write an ALP to convert hexadecimal to decimal number. Store results in 31h location. (06 Marks)

Module-3

- 5 a. With a neat diagram, explain the range of jump instruction. (07 Marks)
- b. Explain the role of call and subroutine in 8051 with an example. (07 Marks)
- c. Write an ALP to move block of data from 30h location to 40h location (any five 8-bit data) using jump instruction. (06 Marks)

OR

- 6 a. Write a 8051 C-program to toggle the bits of P1 ports continuously with a 250 ms delay. (06 Marks)
- b. Explain the bitwise logical operator in C with an example. (08 Marks)
- c. Explain the different data types in 8051 C-programming with size and range. (06 Marks)

Module-4

- 7 a. Write an ALP to transfer "ECE" serially at 9600 baud rate, 8 bit data, 1 stop bit continuously. (07 Marks)
- b. Explain the bit contents of TMOD register. (06 Marks)
- c. Write an ALP to generate a square wave with an ON-time of 3 ms and OFF time of 10 ms on all pins of Port 0. Assume an XTAL of 22 MHz. (07 Marks)

OR

- 8 a. Explain how timers are programmed in Mode 1 with diagram. (07 Marks)
- b. Explain the bit content of SCON-register. (07 Marks)
- c. Explain RS232 DB-9 pins connector. (06 Marks)

Module-5

- 9 a. Explain the bit content of IE register. (05 Marks)
 - b. List the steps involved in executing interrupt in 8051 microcontroller. (05 Marks)
 - c. Write an ALP to interface stepper motor clockwise to 8051 microcontroller with diagram. (10 Marks)
- OR
- 10 a. Write an ALP and C-program for ADC 0804. (10 Marks)
 - b. With a neat diagram, write an ALP to interface LCD to microcontroller 8051 using busy flag. (10 Marks)
