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21EC33

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

1 a. Show that the vectors (1, 2, 1), (2, 1, 0), (1, -1, 2) from a basis of R^3. **(08 Marks)**

b. Apply Gram Schmidt process to the vectors $V_1 = (2, 2, 1)$, $V_2 = (1, 3, 1)$, $V_3 = (1, 2, 2)$ to obtain an orthonormal basis for $V_3(R)$ with the standard inner product. **(12 Marks)**

OR

2 a. Reduce the matrix A to echelon form and also find the rank.

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$ **(10 Marks)**

b. Determine the null space of each of the following matrices.

i) $A = \begin{bmatrix} 2 & 0 \\ -4 & 10 \end{bmatrix}$ ii) $B = \begin{bmatrix} 1 & -7 \\ -3 & 21 \end{bmatrix}$ **(10 Marks)**

Module-2

3 a. Find the eigen values and eigen vectors of the matrix

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

b. Diagonalize the following matrix

$$A = \begin{bmatrix} 1 & 3 & 3 \\ -3 & -5 & -3 \\ 3 & 3 & 1 \end{bmatrix}$$

Find an invertible matrix P and a diagonal matrix D such that $A = PDP^{-1}$. **(10 Marks)**

OR

4 a. Find the singular value decomposition of the matrix $A = \begin{bmatrix} 2 & 3 \\ 0 & 2 \end{bmatrix}$ **(10 Marks)**

b. What is the positive definite matrix? If $A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$, show that A is positive definite matrix. **(10 Marks)**

Module-3

5 a. Define systems. Explain the communication system with a suitable block diagram. **(06 Marks)**

b. Given the signal x[n] show in Fig Q5(b), sketch the following :

i) x[4 – n]

ii) x[2n + 1].

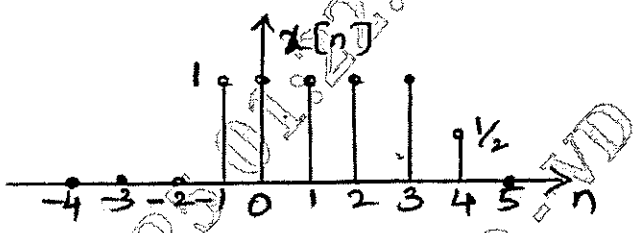

Fig Q5(b)

c. Explain the following elementary signals **(06 Marks)**

i) Unit step signal

ii) Impulse signal

iii) Ramp function

iv) Sinusoidal function. **(08 Marks)**

OR

6 a. Explain with an example :

i) Amplitude scaling

ii) Time scaling

iii) Time shifting

iv) Precedence rule. **(08 Marks)**

b. Verify the following system for linearity, time invariance, memoryless, stability and causality.

i) $y(n) = nx(n)$ ii) $y(n) = 2x[2^n]$. **(12 Marks)**

Module-4

7 a. What do you mean by impulse response of an LTI system? Starting from fundamental, deduce the equation for the response of an LTI system, if the input sequences x[n] and the impulse response h[n] are given. **(08 Marks)**

b. Find the discrete time convolution sum given below

$y(n) = \beta^n u(n) * \alpha^n u(n) ; |\beta|<1 \ \& \ |\alpha|<1$ **(06 Marks)**

c. With suitable diagram, explain the cascade connection and parallel connection of systems. **(06 Marks)**

OR

8 a. A LTI system has an impulse response $h(n) = \begin{cases} 1 ; n = \pm 1 \\ 2 ; n = 0 \\ 0 ; \text{otherwise} \end{cases}$

Determine the output of this system in response to the input.

$x(n) = \begin{cases} 2 ; n = 0 \\ 3 ; n = 1 \\ -2 ; n = 2 \\ 0 ; \text{otherwise} \end{cases}$ **(08 Marks)**

b. Explain the following properties of system in terms of impulse response
i) Memoryless ii) Causal iii) Stable. **(06 Marks)**

c Consider the interconnection of four LTI systems as depicted in Fig Q8(c).

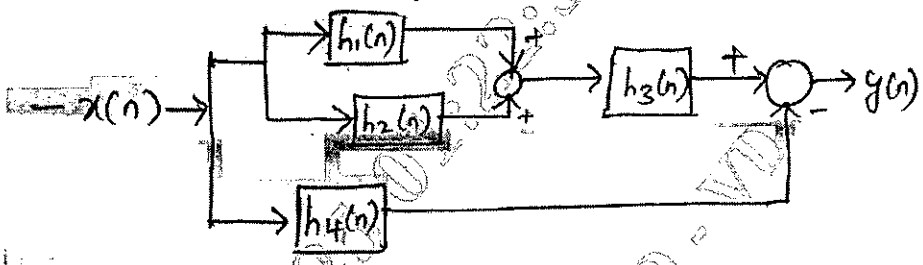

Fig Q8(c)

The impulse response of the systems are
$h_1(n) = U(n)$; $h_2(n) = U(n+2) - U(n)$; $h_3(n) = \delta(n-2)$, $h_4(n) = \alpha^n U(n)$. Find impulse response h(n) of the overall system. **(06 Marks)**

Module-5

9 a. State and prove :
i) Time reversal
ii) Differentiation in Z-domain property of Z-transform. **(08 Marks)**

b. Use partial fraction expansion to find the inverse Z-transform of

$$x(z) = \frac{1+2z^{-1}+z^{-2}}{1-\frac{3}{2}z^{-1}+\frac{1}{2}z^{-2}} \text{ with ROC, } |z|>1$$ **(12 Marks)**

OR

10 a. List the properties of z-transform. **(06 Marks)**

b. A causal system has input x(n) and output y(n). find the impulse response of system if

$$x(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2)$$

$$y(n) = \delta(n) - \frac{3}{4}\delta(n-1)$$ **(08 Marks)**

c. Find the Z-transform of the signal $x(n) = a^n U(n)$. Indicate the ROC and location of poles and zeros of x(z) in the Z plane. **(06 Marks)**

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21EC51

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
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 M – ary QAM. Obtain the constellation of QAM for M = 4 and draw the signal space diagram. **(06 Marks)**

b. An FSK system transmits binary data at the rate of 2.5×10^6 bits/s. During the course of transmission, white Gaussian noise of zero mean and power spectral density 10^{-20} W/HZ is added to the signal. In the absence of noise, the amplitude of the received sinusoidal wave for digit 1 or 0 is 1 μv. Determine the average probability of symbol error for binary FSK using coherent detection. **(04 Marks)**

c. Derive the expression for error probability of BPSK using coherent detection. **(10 Marks)**

OR

2 a. Describe the QPSK signal with its signal space diagram. With a neat block diagram, explain the generation and detection of QPSK signals. **(10 Marks)**

b. Derive the expression for probability of symbol error of coherent binary FSK. **(10 Marks)**

Module-2

3 a. Explain the geometric representation of signals and express the energy of the signal in terms of the signal vector. **(10 Marks)**

b. With a neat block diagram, explain the digital PAM transmission through band limited baseband channels and obtain the expression for ISI. **(10 Marks)**

OR

4 a. Explain the correlation receiver using product integrator and matched filter. **(10 Marks)**

b. The waveforms of three signals are as shown :

$S_1(t) = 1,\ 0 < t < \frac{T}{3}$

$S_2(t) = 1,\ 0 < t < \frac{2T}{3}$

$S_3(t) = 1,\ \frac{T}{3} < t < T$

And zero otherwise. Using the Gram – Schmidt orthogonalization procedure, find an orthonormal basis for this set of signals. **(10 Marks)**

Module-3

5 a. Explain the generation of direct sequence spread spectrum signal, with relevant waveforms and spectrums. Also, explain the effect of dispreading on Narrowband interference. **(10 Marks)**

b. With a neat block diagram, explain the CDMA system based on IS-95. **(10 Marks)**

OR

6 a. With a neat block diagram, explain the frequency hopped spread spectrum techniques. **(10 Marks)**

b. Explain the model of spread spectrum digital communication system. Also, write a note on applications of DS spread – spectrum signals. **(10 Marks)**

Module-4

7 a. Define :
i) Self Information
ii) Entropy
iii) Rate of Information **(03 Marks)**

b. A black and white TV picture consists of 525 lines of picture information. Assume that each line consists of 525 picture elements and that each element can have 256 brightness levels. Pictures are repeated at the rate of 30 frames/ second. Calculate the average rate of information conveyed by a TV set to a viewer. **(05 Marks)**

c. An information source produces a sequence of independent symbols having the following symbol probabilities :

Symbols	A	B	C	D	E	F	G
Probability	1/3	1/27	1/3	1/9	1/9	1/27	1/27

Construct binary Huffman codes. Obtain code efficiency and redundancy. Draw tree diagram for the codes. **(12 Marks)**

OR

8 a. Explain different properties of code. Mention Kraft's inequality condition. **(10 Marks)**

b. Apply Shannon's binary encoding algorithm for the source emitting independent symbols having the following symbol probabilities:

Symbols	A	B	C	D	E	F	G
Probability	9/32	3/32	1/16	3/32	3/32	3/32	9/32

Obtain code efficiency and redundancy. Draw tree diagram for the codes. **(10 Marks)**

Module-5

9 a. The parity check bits of (6, 3) linear block code is given by :
$C_4 = d_1 + d_2$; $C_5 = d_1 + d_2 + d_3$; $C_6 = d_2 + d_3$ where d_1, d_2 , d_3 are message bits.
i) Find the generator matrix and parity check matrix for this code.
ii) Find all possible code vectors
iii) Draw encoder circuit
iv) How many errors can be detected and corrected.
v) If single error has occurred in the received vector [101110] detect and correct the error. **(10 Marks)**

b. For the convolution encoder shown in fig. 9(b). Find the encoder output produced for the message sequence [10011] using
i) Time domain approach
ii) Transform domain approach

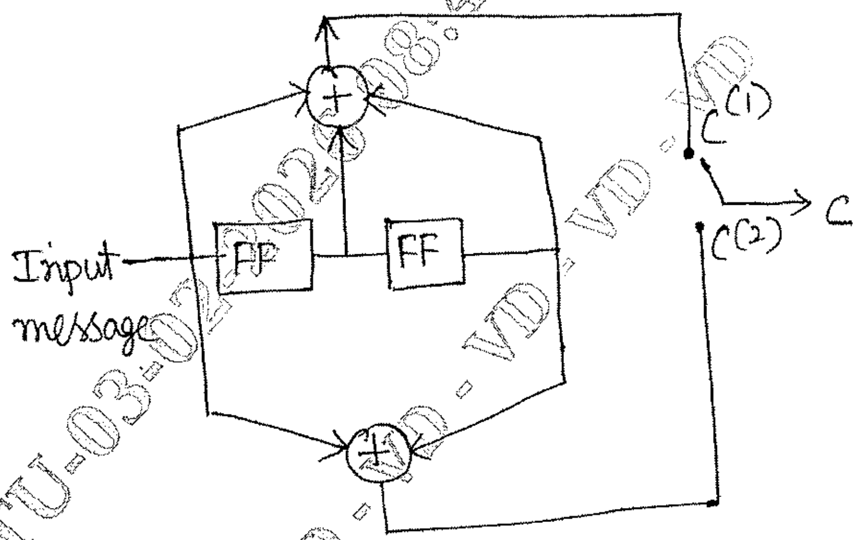

Fig. Q.9(b)

(10 Marks)

OR

10 a. For the convolutional encoder shown in fig. 10(a).

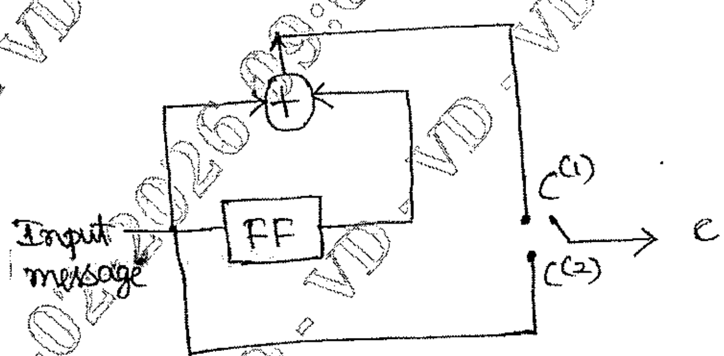

Fig. Q. 10 (a)

Draw state diagram, code tree and Trellis diagram. Find the code vector for the message sequence [1 0 1] **(12 Marks)**

b. Construct the standard array for (4,2) code. If $G = \begin{bmatrix} 1 & 0 & | & 1 & 1 \\ 0 & 1 & | & 0 & 1 \end{bmatrix}$

If R = [1 1 1 1] find the correct code vector. **(08 Marks)**

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21EC54

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
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 vector form of coloumb's law of force between two point charges and indicate the units of the quantities in the equation. **(06 Marks)**

b. A charge of $Q_1 = 3 \times 10^{-4}$C at M(1, 2, 3) and a charge of $Q_2 = -10^{-4}$C at N(2, 0, 5) in a vacuum. Find the force exerted on Q_2 by Q_1. **(06 Marks)**

c. Derive an expression for the electric field intensity due to infinite line charge. **(08 Marks)**

OR

2 a. Explain the following terms with mathematical expressions with respect to electrostatics:
i) Volume charge density
ii) Line charge density
iii) Surface charge density
iv) Electric flux density **(10 Marks)**

b. Find electric flux density $\vec{D}$ in Cartesian co-ordinate system at a point P(6, 8, -10) due to
i) A point charge of 40 mc at the origin and
ii) A uniform line charge of $\rho_L = 40$ μc/m on the z-axis.
iii) A uniform surface charge of density $\rho_S = 57.2$ μc/m^2 on the plane x = 12 m. **(10 Marks)**

Module-2

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

b. In a certain region of space $\vec{D} = 2xy\ \vec{a}_x + 3yz\ \vec{a}_y + 4zx\ \vec{a}_z$. Evaluate the amount of electric flux that passes through the portion bounded by $-1 \le y \le z$ and $0 \le z \le 4$ in the x = 3 plane. **(08 Marks)**

c. Prove that $\rho_V = \nabla.D$ **(06 Marks)**

OR

4 a. Establish relation $E = -\nabla V$ **(06 Marks)**

b. If three charges 3 μc, 4 μc and 5μc are located at (0, 0, 0), (2, -1, 3) and (0, 4, -2) respectively. Find the potential at (1, 0, 1) assuming zero potential at infinity. **(08 Marks)**

c. Let $\vec{D} = 5r^2\ \vec{a}_r$ mc/m^2 for r < 0.08 m and $\vec{D} = \frac{0.1}{r^2}\ \vec{a}_r$ mc/m^2 for r > 0.08 m
i) Find charge density for r = 0.06 m
ii) Find charge density for r = 0.1 m **(06 Marks)**

Module-3

5 a. Derive an expression for Poisson's and Laplace's equation. **(05 Marks)**

b. State and prove uniqueness theorem. **(08 Marks)**

c. Determine whether or not the following potential fields satisfy the Laplace's equation.
i) $v = x^2 - y^2 + z^2$
ii) $v = r\cos\phi + z$ **(07 Marks)**

OR

6 a. State and explain Ampere circuital law. **(06 Marks)**

b. Given the general vector $\vec{A} = (\sin 2\phi)\vec{a}_\phi$ in cylindrical co-ordinates. Find the curl of $\vec{A}$ at $(2, \pi/4, 0)$ **(08 Marks)**

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

Module-4

7 a. Derive an expression for force on a differential current element. **(08 Marks)**

b. A conductor 6 m long lies along z-direction with a current of 2A in $\vec{a}_z$ direction. Find the force experienced by conductor if $\vec{B} = 0.08\vec{a}_x$ T **(04 Marks)**

c. A current element $I_1 \overrightarrow{\Delta L_1} = 10^{-5}\vec{a}_z$ A – m is located at P_1 (1, 0, 0) while a second element. $I_2 \overrightarrow{\Delta L_2} = 10^{-5}(0.6\vec{a}_x - z\vec{a}_y + 3\vec{a}_z)$ A – m is at P_2 (-1, 0, 0) both in free space. Find the vector force exerted on $I_2 \overrightarrow{\Delta L_2}$ by $I_1 \overrightarrow{\Delta L_1}$. **(08 Marks)**

OR

8 a. If $\vec{B} = 0.05x\,\vec{a}_y$ T in a material for which $X_m = 2.5$. Find :

i) μ_r ii) μ iii) $\vec{H}$ iv) $\vec{M}$ v) $\vec{J}$ **(10 Marks)**

b. Write a note on forces on magnetic material and magnetic circuits. **(10 Marks)**

Module-5

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

b. State and explain Faraday's law of electromagnetic induction. **(08 Marks)**

c. The depth of penetration in a region of certain conducting medium is 0.1 m. The frequency of the electromagnetic wave is one Mega Hertz. Find the conductivity of the conducting medium. **(04 Marks)**

OR

10 a. Obtain solution of the wave equation for a uniform plane wave in free space. **(06 Marks)**

b. State and prove Poynting theorem. **(08 Marks)**

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

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21EC71

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
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. Discuss the channeled and channeless gate arrays. **(06 Marks)**

b. Mention the important features of PLD and explain the Essential Characteristics of FPGA. **(06 Marks)**

c. Discuss the functions of each step in the ASIC Design Flow. **(08 Marks)**

OR

2 a. Explain Dadda Multiplier [6 bit] and its advantages over Wallace. **(10 Marks)**

b. Discuss
i) Datapath Logic Cell ii) Datapath Elements iii) I/O cells **(10 Marks)**

Module-2

3 a. What is Floor Planning? Briefly explain the goals and objectives of floor planning. **(08 Marks)**

b. What is Channel Definition? Explain in brief about channel definition of an ASIC system floor planning. **(06 Marks)**

c. Explain the Mini-cut Placement method in brief. **(06 Marks)**

OR

4 a. List and goals and objectives of global routing and explain in brief about global routing methods. **(08 Marks)**

b. Explain the left edge algorithm for channel routing. **(06 Marks)**

c. Discuss the clock and power routing. **(06 Marks)**

Module-3

5 a. List the verification methodologies and explain constrained random stimulus methodology basics. **(10 Marks)**

b. Define Testbench? Explain testbench components with the help of a neat diagram. **(10 Marks)**

OR

6 a. Explain Fixed, Dynamic, Queue and associative array operations with examples. **(10 Marks)**

b. Explain the guidelines for choosing a storage type in the system varilog. **(10 Marks)**

Module-4

7 a. Write the different between Tasks and function in system verilog. **(06 Marks)**

b. Explain the routine arguments with suitable examples. **(08 Marks)**

c. Discuss time values of system verilog with examples. **(06 Marks)**

OR

8 a. Describe the communication between the testbench and DUT with suitable diagram and examples. **(10 Marks)**

b. List and explain different types of system verilog assertions. **(10 Marks)**

Module-5

9 a. What is Randomization? Explain device and environment configuration and randomization. **(10 Marks)**

b. Describe any two solution probabilities in system verilog with examples. **(10 Marks)**

OR

10 a. Define Functional Coverage. Explain coverage convergence using neat diagram. **(10 Marks)**

b. List coverage type of verification and compare code coverage and functional coverage. **(10 Marks)**

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21EC72

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
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. Derive an expression for Numerical aperture in terms of acceptance angle and relative refractive index profile. **(08 Marks)**

b. What is Attenuation? Explain the following attenuation mechanisms with relevant expressions : i) Absorption ii) Scattering losses. **(08 Marks)**

c. For a 30 km long fiber, attenuation is 0.8 dB/km at 1300 nm. If a 200 μW power is launched into the fiber, find the O/P power. **(04 Marks)**

OR

2 a. Explain material dispersion with relevant expressions. **(06 Marks)**

b. Sketch and explain :
i) Step index fibers ii) Graded index fiber with core and cladding diameters **(08 Marks)**

c. Classify and explain different fiber materials used in optical fibers. **(06 Marks)**

Module-2

3 a. Explain the concept of WDM with implementation diagram. **(06 Marks)**

b. Construct and explain surface emitter LED with neat diagram. **(08 Marks)**

c. A given Silicon Avalanche Photodiode has a Quantum efficiency of 65% at a wavelength of 900 nm. Suppose 0.5 μw of optical power produces a multiplied photocurrent of 10μA. Calculate i) Primary photo current ii) Multiplication factor iii) Responsivity **(06 Marks)**

OR

4 a. Explain the working of Faraday rotation isolator with neat diagram. **(06 Marks)**

b. Construct and explain Fabry-Perot LASER with neat diagram. **(08 Marks)**

c. Explain PIN photodiode with neat diagram. **(06 Marks)**

Module-3

5 a. With neat diagram, explain Frequency reuse concept with cluster size k = y. **(06 Marks)**

b. What is Fading? Explain different types of small scale fading with relevant diagram. **(10 Marks)**

c. A US AMPS analog cellular system is allocated 12.5 MHz for each simplex band. If the Guard band at either end of the allocated spectrum is 10 KHz and the channel bandwidth is 30 KHz. Find the number of channels available in the system. **(04 Marks)**

OR

6 a. Explain 2G digital cellular systems with their specifications. **(04 Marks)**

b. Explain the following propagation mechanism with relevant diagram :
i) Reflection ii) Diffraction. **(08 Marks)**

c. Derive an expression for frequency reuse ratio in terms of cluster size given by $Q = \sqrt{3K}$. Assume Regular Hexagonal geometry. **(08 Marks)**

Module-4

7 a. Explain main parts of a basic cellular system connected to PSTN with neat diagram. **(10 Marks)**

b. Explain the concept of OFDM used in OFDMA with neat diagram. **(06 Marks)**

c. Consider GSM which uses 25 MHz for the forward link, which is divided into radio channels of 200 KHz each with 8 time slots per channel. Find the number of simultaneous subscribers that can be accommodated in GSM – Assuming no Guard band. **(04 Marks)**

OR

8 a. Explain the TDMA / FDMA hybrid techniques used in
i) IS – 136 system ii) GSM system with relevant diagrams. **(08 Marks)**

b. With neat diagram, explain the steps required to establish Mobile to Mobile call. **(06 Marks)**

c. Explain the concept of FDMA / FDD used in AMPS analog cellular system. **(06 Marks)**

Module-5

9 a. Explain different identifiers used in GSM system with relevant formats. **(10 Marks)**

b. List any 8 specifications of GSM air interface standard. **(04 Marks)**

c. Explain GSM Traffic Channels with relevant diagram. **(06 Marks)**

OR

10 a. Explain different hand – off procedures used in GSM. **(04 Marks)**

b. Explain GSM hyper frame format with neat diagram. **(08 Marks)**

c. Explain GSM signaling protocol architecture with different layers and neat diagram. **(08 Marks)**

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21EC732

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
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. What is Digital Image Processing? Explain the fundamental steps in image processing with neat block diagram. **(10 Marks)**

b. Explain the components of an Image Processing System. **(10 Marks)**

OR

2 a. Describe the Image sensing and acquisition process. **(10 Marks)**

b. Explain 4, 8 and m adjacency with an example. **(06 Marks)**

c. Discuss Image Sampling and Quantization. **(04 Marks)**

Module-2

3 a. Define forward and inverse 2D fourier transform in detail. Prove any two properties. **(06 Marks)**

b. Check whether the matrix $A = \frac{1}{\sqrt{2}}\begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix}$ is unitary or not. **(04 Marks)**

c. Compute Discrete Cosine Transform for N = 4. **(10 Marks)**

OR

4 a. Derive the algorithmic steps for Haar Transform. **(10 Marks)**

b. Explain KL transform with necessary equations. **(10 Marks)**

Module-3

5 a. Define Histogram. Discuss histogram equalization used in image enhancement. **(10 Marks)**

b. Perform histogram equalization for the given image.

Gray level	0	1	2	3	4	5	6	7
No. of pixels	790	1023	850	656	329	245	122	81

(10 Marks)

OR

6 a. Discuss the basic intensity transformation functions. **(10 Marks)**

b. Explain the smoothing filters in the spatial domain. **(10 Marks)**

Module-4

7 a. Discuss the filters used to sharpen an image in frequency domain. **(10 Marks)**

b. What is the function of a color model? How the HSI model is converted to RGB model? Explain. **(10 Marks)**

OR

8 a. What is Pseudocolor Image Processing? Explain intensity slicing in pseudocolor image processing. **(10 Marks)**

b. Write a short note on Homomorphic Filtering. **(10 Marks)**

Module-5

9 a. Draw the Image Degradation Model. **(04 Marks)**

b. Explain the concept of inverse filtering. **(06 Marks)**

c. Explain the following :
(i) Median filter
(ii) Alpha trimmed mean filter
(iii) Max and min filters **(10 Marks)**

OR

10 a. Derive the expression for mean square error using Wiener filter. **(10 Marks)**

b. Discuss the different types of noise models with their probability density functions. **(10 Marks)**

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21EC643

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
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 the rules of precedence used by Python to evaluate an expression with an example. **(05 Marks)**

b. Explain common data types in Python and associated type casting functions. **(10 Marks)**

c. Write a Python program to display name, age of person in a year and length of name. Ask input from user. **(05 Marks)**

OR

2 a. Explain flow control statements in Python with an example. **(10 Marks)**

b. What are user defined functions? How can we pass parameters in user defined functions? Explain with suitable example. **(06 Marks)**

c. Write a python program to demonstrate division by zero error using try and except. **(04 Marks)**

Module-2

3 a. Explain the following concepts in list using an example :
(i) Indexing.
(ii) Slicing
(iii) Changing values in list with Indexes.
(iv) Multiple Assignment Trick.
(v) Removing values from list with del statements. **(10 Marks)**

b. Explain various list and dictionary methods with an example. **(10 Marks)**

OR

4 a. Differentiate between list and Dictionary. **(04 Marks)**

b. Write a Python program to count the number of occurrence of each letter in a string. **(06 Marks)**

c. List and explain with an example useful string methods supported by python. **(10 Marks)**

Module-3

5 a. List and explain all the characters that are used in regular expression to match the pattern. **(10 Marks)**

b. With an example program, explain search ( ) and find all ( ) method for pattern matching with regular expression. Also explain group ( ) method. **(10 Marks)**

OR

6 a. With an example, explain file reading and writing process in python. **(10 Marks)**

b. Explain with an example program storing and retrieving variables with shelve module. **(10 Marks)**

Module-4

7 a. What is Class? How to define class in Python? Explain Attributes in Python language with examples. **(08 Marks)**

b. Illustrate the concept of Pure functions and Modifier with examples. **(06 Marks)**

c. With an example, explain shallow copy and deep copy. **(06 Marks)**

OR

8 a. Illustrate how_str_method is invoked when you print an object. **(06 Marks)**

b. What is the difference between method and function? Explain the working of init method with suitable code. **(06 Marks)**

c. What is operator overloading? Write a python code to overload "+", "−" and "*" operator by providing the methods __add__, __sub__ and __mul__ **(08 Marks)**

Module-5

9 a. Write a python program for retrieving the romeo.txt file from the web and compute the frequency of each word in a file. **(06 Marks)**

b. Write a note on XML. Write a python program to retrieve a node present in XML. **(08 Marks)**

c. What is service oriented architecture? List the advantages of same. **(06 Marks)**

OR

10 a. Demonstrate with the python program,
(i) To retrieve an image over HTTP.
(ii) To retrieve web pages with urllib. **(08 Marks)**

b. Compare and contrast the Java Script Object Notation (JSON) and Extensible Markup Language (XML). **(06 Marks)**

c. Define Cursor. Explain connect, Execute and close command of databases with a snippet code. **(06 Marks)**

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21EC652

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Microcontrollers

Time: 3 hrs. Max. Marks: 100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. In case of any missing data then assume the values.

Module-1

1 a. Compare microprocessor and microcontroller. **(06 Marks)**

b. With the help of neat diagram, explain the architecture of 8051 microcontroller. **(10 Marks)**

c. List some applications of 8051 microcontroller. **(04 Marks)**

OR

2 a. Draw and explain memory structure of 8051. **(10 Marks)**

b. Describe the function of various pins of 8051 microcontroller with pin diagram. **(10 Marks)**

Module-2

3 a. Explain the different addressing modes of 8051. **(10 Marks)**

b. Write an ALP to set the carry flag to '1', if the number in reg A is even and reset the carry flag to '0', if the number in reg A is odd. **(04 Marks)**

c. Explain the stack operation instruction PUSH and POP. **(06 Marks)**

OR

4 a. Explain the following instruction with examples
i) MOVC A, @ A + PC ii) SWAP A iii) DA A iv) RRC A v) CJNE **(10 Marks)**

b. Name the instructions which performs bit level logical operations in 8051. Give an example to show bit level logic operation. **(06 Marks)**

c. Write an ALP to find the square of a number of stored in external RAM location 1000H and store the result in external RAM location 1200 H (LSB) and 1201H (MSB). **(04 Marks)**

Module-3

5 a. Explain the different types of conditional and unconditional jump instruction of 8051. **(10 Marks)**

b. Explain CALL and RET instructions. Also explain the steps performed automatically by 8051 during the execution of CALL and RET instruction. **(10 Marks)**

OR

6 a. Explain C data types for 8051 with their data size bits and data range. **(10 Marks)**

b. With the help of examples, explain Bit-wise shift operation in C. **(05 Marks)**

c. A door sensor is connected to the P2.0 and a buzzer is connected to P3.0. Write an 8051 C program to monitor the door sensor, and when it Open, sound the buzzer. You can sound the buzzer by sending square wave of a few hundred HZ. **(05 Marks)**

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Module-4

7 a. Explain the bit structure of TMOD register. **(06 Marks)**

b. Explain Mode-2 programming of 8051 timer. Describe the different steps to program in Mode-2. **(08 Marks)**

c. Write an ALP to generate square wave of 2KHz frequency on pin1.5. Assume that XTAL = 12MHz. **(06 Marks)**

OR

8 a. Explain SCON register in detail. **(08 Marks)**

b. Write an ALP to transfer the message "YES" serially at 9600 band, 8-bit data, 1-stop bit. Do this continuously. **(06 Marks)**

c. Explain the programming of the 8051 to receive character bytes serially. **(06 Marks)**

Module-5

9 a. What is an interrupt? How are interrupts method is different from polling method in serving devices? **(06 Marks)**

b. List the six interrupts in the 8051. Explain the steps of execution when an interrupt is requested. **(08 Marks)**

c. What is interrupt vector table? Explain interrupt vector table with a suitable example. **(06 Marks)**

OR

10 a. Interface a LCD display with 8051 and write a C program to send letters 'V', 'T', and 'U' to the LCD display using delays. (Draw the interfacing diagram showing the pin connections). **(10 Marks)**

b. Draw the interfacing diagram of stepper motor and the 8051. Write a C program to monitor the status of a switch 'SW' connected to the pin 2.7 and perform the following :

i) If SW = 0 : the stepper motor should rotate in clockwise direction

ii) If SW = 1 : the stepper motor should rotate in anti-clockwise direction **(10 Marks)**

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