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PRESIDENCY UNIVERSITY BENGALURU

SCHOOL OF ENGINEERING

MAKEUP EXAMINATION – JULY 2024

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| **Semester : 4** | **Date : 04-07-2024** |
| **Course Code : CSA3056** | **Time : 09.30am to 12.30Pm** |
| **Course Name: Intelligent Signal Processing** | **Max Marks :100** |
| **Program :B.Tech** | **Weightage :50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** | | | |
| **ANSWER ANY 4 QUESTIONS 4Q X 5M=20M** | | | |
| 1 | Boolean expression is a logical statement that is either TRUE or FALSE. Boolean expressions can compare data of any type as long as both parts of the expression have the same basic data type. Prove that 𝑋 ⋅ (𝑋 + 𝑌) = 𝑋 | (CO 1) | [Knowledge] |
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| 2 | A truth table is a breakdown of all the possible truth values returned by a logical expression. Write out the Truth Table for AND, OR and XOR gate | (CO 2) | [Knowledge] |
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| 3 | An analog signal is a voltage, current, or physical quantity that continuously and infinitely varies in accordance with some time-varying parameter. For example, radio waves, television waves, or sound waves are all examples of analog signals. If we start with the analog signal, which three operations so we use to convert it to the digital ‘equivalent’? | (CO 1) | [Knowledge] |
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| 4 | The resolution of Digital to Analog Converter is given by the number of bits, N. The resolution is the smallest increment of output that the DAC can produce. For a range of 0-5V, and a 3-bit resolution, what is the binary value for 5.5 V? | (CO 1) | [Knowledge] |
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| 5 | In mathematical physics, the Dirac delta distribution (δ distribution), also known as the unit impulse,[1] is a generalized function or distribution over the real numbers, whose value is zero everywhere except at zero, and whose integral over the entire real line is equal to one. For the sequence x[n] = {2, -3, 1, 0, 1, -3, 2}, express the signal x[n] as shifted version of impulse (delta) signal. | (CO 1) | [Knowledge] |
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| 6 | In mathematics (in particular, functional analysis), convolution is a mathematical operation on two functions (f and g) that produces a third function, that expresses how the shape of one is modified by the other. Write the expression for convolution operation. And explain with proper diagram. | (CO 4) | [Knowledge] |
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| **PART B** | | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** | | | | |
| 7 | In mathematics, even functions and odd functions are functions which satisfy particular symmetry relations, with respect to taking additive inverses.    Find  (i) Xe [n]+ Xo[n]  (ii) Xe [n]- Xo[n]  Where Xe [n] is the even symmetric signal and Xo[n] is the odd symmetric signal | (CO 2) | [Comprehension] |
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| 8 | In mathematics (in particular, functional analysis), convolution is a mathematical operation on two functions (x[n] and h[n]) that produces a third function (x[n]\* h[n]) that expresses how the shape of one is modified by the other. Draw the input signal x[n]=2δ [n+2]+δ [n+1]+δ [n]+δ [n-1].  Also find the output signal using convolution operation for a system with response  h[n]=2δ [n+1]+δ [n]+2δ [n-1]-3δ [n-2] | (CO 2) | [Comprehension] |
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| 9 | Draw (i) x [2n],  (ii) x [n-1],  (iii) x [-n]  (iv) x [n/3] | (CO 2) | [Comprehension] |
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| 10 | A discrete-time signal is a sequence of values that correspond to particular instants in time. The time instants at which the signal is defined are the signal's sample times, and the associated signal values are the signal's amplitudes. For the signal    Draw (i) x [n/2]  (iii) x[0.25n] | (CO 4) | [Comprehension] |
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| 11 | Self-information is a measure of the information content associated with the outcome of a random variable. It is expressed in a unit of information, for example bits. Consider a source S= { with probabilities p = { }. Find the following:  Entropy of source ‘S’, and Information rate R\_s in bits/sec. | (CO 4) | [Comprehension] |
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| 12 | You have a -5 to 5V signal. Separate the voltage range such that it fits into a 4-bit number. Draw the table for Discrete Voltage Ranges (V) for the sixteen output states and the corresponding Output Binary Equivalent. | (CO 2) | [Comprehension] |
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| 13 | Resolution is the smallest voltage that can be encoded digitally, in other words the voltage represented by the least significant bit. For a range of -5 to 5V, and a 4-bit resolution, what is the binary value for 4.5V? | (CO 1) | [Comprehension] |
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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 15M=30M** | | | |
| 14 | An analog signal is a voltage, current, or physical quantity that continuously and infinitely varies in accordance with some time-varying parameter. Convert the following time varying signal of 0 - 7 V to a digital signal using a 3-bit ADC. | (CO 1) | [Application] |
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| 15 | A discrete time signal cannot take real values of time. It can only take discrete values of time. For the signal x[n] = {2, -3, 1, 0, 1, -3, 2}    Draw (i) x [3n],  (ii) x [n-2],  (iii) x [-n] | (CO 2) | [Application] |
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| 16 | You have a 0-10V signal. Separate the voltage range such that it fits into a 3-bit number. Draw the table for Discrete Voltage Ranges (V) for the eight output states and the corresponding Output Binary Equivalent | (CO 3) | [Application] |
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