Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Electronics) (Fourth Semester)

EXAMINATION, July, 2022

(Elective Course)

DIGITAL SIGNAL PROCESSING

Paper Code				
ELC	4	0	4	(B)

Questions Booklet Series
B

Time : 1:30 Hours] [*Maximum Marks : 100*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 60 questions. Examinee is required to answer any 50 questions in the OMR Answer-Sheet provided and not in the question booklet. If more than 50 questions are attempted by student, then the first attempted 50 questions will be considered for evaluation. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 60 प्रश्न हैं। परीक्षार्थी को किन्हीं 50 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। यदि छात्र द्वारा 50 से अधिक प्रश्नों को हल किया जाता है तो प्रारम्भिक हल किये हुए 50 उत्तरों को ही मूल्यांकन हेतु सम्मिलित किया जाएगा। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) (शेष निर्देश अन्तिम पृष्ठ पर)

(Only for Rough Work)

1. Find the number of smallest DFTs required to compute the linear convolution of length 40 sequences with a length of 900 another sequences using 64 DFT :

(A) 36

(B) 64

(C) 54

(D) 28

2. Determine the number of complex additions required for 32 direct computations of DFT :

(A) 240

(B) 56

(C) 992

(D) 854

3. Find the complex multiplications required for 16 direct computations of DFT :

(A) 256

(B) 64

(C) 216

(D) 1024

4. Which of the following statements is incorrect about DIT- FFT ?

(A) It requires complex additions of 'N log 2N'.

(B) The number of input samples is given by 2^i.

(C) The input sequence is represented in bit-reversal order.

(D) The output sequence is represented in bit-reversal order.

5. The algorithm used for the computation of DFT based on the decomposition of N-point DFT is known as :

(A) Overlap save

(B) Phase algorithm

(C) Divide and Conquer

(D) Both (A) and (B)

6. The advantages of the butterfly structure is :

(A) Reduces computation complexity.

(B) Requires a fewer number of multiplications and additions.

(C) Combines the result of small DFTs into larger DFTs.

(D) All of the above

7. Which of the following is/are feature(s) of the digital signal processor ?

(A) It can handle real-time processing.

(B) It performs fast processing of arrays.

(C) On-chip registers of the processor cannot store intermediate results.

(D) Both (A) and (B)

8. Which of the following bus is used in the digital signal processor ?

(A) Program memory bus

(B) Data memory bus

(C) Both (A) and (B)

(D) None of the above

9. Which of the following form is used for the IIR filters ?

(A) Direct form-I

(B) Indirect from-I

(C) Direct form-III

(D) Direct form-IV

10. The multipliers required for the (M – 1) and (N – 1) order IIR filters are given by ..... .

(A) M + N + 1

(B) M + N – 2

(C) M + N – 1

(D) M + 2N + 1

11. The incorrect statement about FIR filters is :

(A) FIR filters are always stable.

(B) Its realization can be done using recursive structures.

(C) Its realization can be done using non-recursive structures.

(D) FIR filters are not immune to noise.

12. Which of the following features about the triangular window technique used in the FIR filter design is correct ?

(A) The main lobe width is thrice that of rectangular window.

(B) The minimum stop band attenuation required for designing filters is 15 dB.

(C) The minimum stop band attenuation required for designing filters is 28 dB.

(D) Its side lobe magnitude of the window spectrum remains constant.

13. The incorrect statement about the effects of windowing in filters is :

(A) The concept of windowing introduces side lobes.

(B) The windowing concept in the time domain results in the smoothing in the frequency domain.

(C) It helps in converting an infinite duration signal into finite.

(D) None of the above

14. Which type of filters are all pole filters ?

(A) Type- I Chebyshev filters

(B) Type- II Chebyshev filters

(C) Both (A) and (B)

(D) None of the above

15. Which of the following is/are standard test signals ?

(A) Step

(B) Impulse

(C) Exponential

(D) All of the above

16. Which filters exhibit their dependency upon the system design for the stability purpose ?

(A) FIR

(B) IIR

(C) Both (A) and (B)

(D) None of the above

17. In the frequency response characteristics of FIR filter, the number of bits per coefficient should be ..... in order to maintain the same error.

(A) increased

(B) constant

(C) decreased

(D) None of the above

18. In cascade form of realization, how many bits should be used to represent the FIR filter coefficients in order to avoid the quantization effect on filter coefficients ?

(A) 5 to 10

(B) 12 to 14

(C) 20 to 24

(D) 28 to 40

19. In DSP processor, what kind of queuing is undertaken/executed through instruction register and instruction cache ?

(A) Implicate

(B) Explicate

(C) Both (A) and (B)

(D) None of the above

20. In TMS 320 C6X processor architecture, which functional unit is adopted for transferring the data from register to and from control register ?

(A) L_2

(B) M_2

(C) S_2

(D) D_2

21. In TMS 320 C6X processor architecture, which operation(s) is/are performed by 'M' functional unit ?

(A) Bit expansion

(B) Bit interleaving and deinterleaving

(C) Rotation and variable shifting

(D) All of the above

22. In C6X processor, which external device/s get/s acquire/s an interface support by EMIF peripheral ?

(A) Synchronous burst

(B) Asynchronous devices

(C) Externally shared memory devices

(D) All of the above

23. The quality of output signal from A/D converter is measured in terms of ..... .

(A) Quantization error

(B) Quantization to signal noise ratio

(C) Signal to quantization noise ratio

(D) Conversion constant

24. The effects caused due to finite word lengths are ..... .

(A) Coefficient quantization error

(B) Adder overflow limit cycle

(C) Round off noise

(D) Limit cycles

25. If 'F' is the frequency of the analog signal, then what is the minimum sampling rate required to avoid aliasing ?

(A) F

(B) 2F

(C) 3F

(D) 4F

26. Consider the assertions given below. Which among them is an advantage of FIR filter ?

(A) Necessity of computational techniques for filter implementation

(B) Requirement of large storage

(C) Incapability of simulating prototype analog filters

(D) Presence of linear phase response

27. For a linear phase filter, if Z_1 is zero, then what would be the value of Z_1^{-1} or $1 / Z_1$?

(A) Zero

(B) Unity

(C) Infinity

(D) Unpredictable

28. Correlation is used for ..... .

(A) Computation of average power in waveforms

(B) Climatography

(C) Identification of binary code-word in PCM systems

(D) Quantization

29. DFT is applied to ..... .

(A) Infinite sequences

(B) Finite discrete sequences

(C) Continuous infinite signals

(D) Continuous finite sequences

30. The filtering is performed using DFT using ..... .

(A) Limited size or blocks of data

(B) Small memory size

(C) Large memory size

(D) Large segments of data

31. One-dimensional signal is a function of ..... .

(A) Multiple independent variables

(B) Single independent variable

(C) Multiple dependent variables

(D) Single dependent variable

32. What is the lowest order of the Butterworth filter with a pass band gain $K_P = -1$ dB at $\Omega_P = 4$ rad/sec and stop band attenuation greater than or equal to 20 dB at $\Omega_S = 8$ rad/sec ?

(A) 4

(B) 5

(C) 6

(D) 3

33. What is the expression for cut-off frequency in terms of pass band gain ?

(A) $\Omega P(10 - KP / 10 - 1)\, l / 2N$

(B) $\Omega P(10 - KP / 10 + 1)\, l / 2N$

(C) $\Omega P(10\, KP / 10 - 1)\, 1 / 2N$

(D) None of the above

34. Which of the following is a frequency domain specification ?

(A) $0 \geq 20 \log |H(j\Omega)|$

(B) $20 \log |H(j\Omega)| \geq KP$

(C) $20 \log |H(j\Omega)| \leq KS$

(D) All of the above

35. What is the value of gain at the pass band frequency, i.e., what is the value of K_P ?

(A) $-10 \log [1 - (\Omega P \Omega C)\, 2N]$

(B) $-10 \log [1 + (\Omega P \Omega C)\, 2N]$

(C) $10 \log [1 - (\Omega P \Omega C)\, 2N]$

(D) $10 \log [1 + (\Omega P \Omega C)\, 2N]$

36. Which of the following is used in the realization of a system ?

(A) Delay elements

(B) Multipliers

(C) Adders

(D) All of the above

37. Computational complexity refers to the number of ..... .

(A) Additions

(B) Arithmetic operations

(C) Multiplications

(D) None of the above

38. Which of the following refers the number of memory locations required to store the system parameters, past inputs, past outputs and any intermediate computed values ?

(A) Computational complexity

(B) Finite word length effect

(C) Memory requirements

(D) None of the above

39. Which of the following are called as finite word length effects ?

(A) Parameters of the system must be represented with finite precision.

(B) Computations are truncated to fit in the limited precision constraints.

(C) Whether the computations are performed in fixed point or floating point arithmetic.

(D) All of the above

40. If $W_4^{100} = W_x^{200}$, then what is the value of x ?

(A) 2

(B) 4

(C) 8

(D) 16

41. What is the DFT of the four point sequence $x(n) = \{0, 1, 2, 3\}$?

(A) $\{6, -2 + 2j - 2, -2 - 2j\}$

(B) $\{6, -2 - 2j, 2, -2 + 2j\}$

(C) $\{6, -2 - 2j, -2, -2 + 2j\}$

(D) $\{6, -2 + 2j, -2, -2 - 2j\}$

42. If X (k) is the N point DFT of a sequence whose Fourier series coefficients is given by c_k, then which of the following is true ?

(A) $X(k) = Nc_k$

(B) $X(k) = c_k / N$

(C) $X(k) = N / c_k$

(D) None of the above

43. What is the ROC of z-transform of an two sided infinite sequence ?

(A) $|z| > r_1$

(B) $|z| < r_1$

(C) $r_2 < |z| < r_1$

(D) None of the above

44. The Nth rot of unity W_N is given as ..... .

(A) $e^{j2\pi N}$

(B) $e^{-j2\pi N}$

(C) $e^{-j2\pi/N}$

(D) $e^{j2\pi/N}$

45. Which of the following is a digital-to-analog conversion process ?

(A) Staircase approximation

(B) Linear interpolation

(C) Quadratic interpolation

(D) All of the above

46. The product of two odd signals is :

(A) Odd

(B) Even

(C) Both (A) and (B)

(D) Zero

47. The system given by $y(n) = \frac{x(n)+1}{x(n-1)}$ is ..... .

(A) Linear

(B) Causal

(C) Both (A) and (B)

(D) None of the above

48. Which of the following is not a type of discrete system ?

(A) Recursive systems

(B) Dynamic systems

(C) Non-causal systems

(D) Non-dynamic systems

49. The advantages of discrete signal processing is/are ..... .

(A) Cost effective

(B) Time sharing

(C) High flexibility

(D) All of the above

50. Which of the following is the characteristic of the power signal ?

(A) Power signal is infinite.

(B) Power signals are time-limited.

(C) Aperiodic signals are power signals.

(D) None of the above

51. The Digital Signal Processing System ..... .

(A) Consumes more power.

(B) Consumes less power.

(C) is applicable for low-frequency signals.

(D) Both (A) and (C)

52. The length of the output sequence (n) of the two sequences (n_1 and n_2) can be calculated using the formula ..... .

(A) $n = n_1 - n_2 + 1$

(B) $n = n_1 + n_2 - 1$

(C) $n = n_1 - n_2 - 1$

(D) $n = n_1 + n_2 + 1$

53. An analog signal has a bandwidth of 5 kHz. If we are using an N-point DFT to compute the signal spectrum with a resolution less than or equal to 25 Hz, find the minimum length of the signal.

(A) 0.2 s

(B) 0.04 s

(C) 0.02 s

(D) 0 s

54. One-sided *z*-transform is also known as ..... .

(A) Unilateral *z*-transform

(B) Bilateral *z*-transform

(C) Trilateral *z*-transform

(D) None of the above

55. The *z*-transform of the function $y(n) = x(n) + y(n-1)$ is ..... .

(A) $\frac{z}{z+1}$

(B) $\frac{z}{2z}$

(C) $\frac{z}{z-1}$

(D) $\frac{z-1}{z}$

56. The *z*-transform of the signal $a^n x(n)$ is ..... .

(A) X (za)

(B) X (z/a)

(C) X ($z + a/a$)

(D) None of the above

57. The *z*-transform of the impulse response $y(n) = x(n) + 2x(n-1)$ is ..... .

(A) $1 + 2z^{-1}$

(B) $1 + 2z^2$

(C) $1 - 2z$

(D) $\frac{1}{2z}$

58. The addition of zeroes at the end of the sequence when it is represented as the power of integer is referred as ..... .

(A) Region of convergence

(B) Bilateral transform

(C) Zero padding

(D) None of the above

59. The *z*-transform of the system $h(n) = 3^n u(n)$ is ..... .

(A) $\frac{3z}{z-3}$

(B) $\frac{z}{z+3}$

(C) $\frac{z}{z-3}$

(D) None of the above

60. The system that accepts the input in the discrete form and produces the discrete time output is known as :

(A) Linear system

(B) Discrete time system

(C) LTI system

(D) All of the above

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the most correct/appropriate answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.

6. All answers are to be given on OMR Answer sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.

7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.

8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.

9. There will be no negative marking.

10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.

11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.

12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is ny discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर— A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से एक सबसे सही अथवा सबसे उपयुक्त उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।

6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।

7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।

8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।

9. निगेटिव मार्किंग नहीं है।

10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।

11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।

12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।