18. (a) Obtain Laurent's expansion of $f(z) = \dfrac{z^2 - 1}{z^2 + 5z + 6}$ in :

   (i) $|z| < 2$.

   (ii) $2 < |z| < 3$.

   (b) Determine the poles and residues for $f(z) = \dfrac{2z + 1}{z^2 - z - 2}$.

19. A service station has five mechanics each of whom can service a scooter in 2 hours on the average. The scooters are registered at a single counter and then sent for servicing to different mechanics. Scooters arrive at the service station at an average rate of 2 scooters per hour. Assuming that the scooter arrivals are Poisson distributed and the service times are exponentially distributed, determine :

   (a) Utilization factor.

   (b) The probability that the system shall be idle.

   (c) The expected number of scooters waiting in the queue.

   (d) The expected number of scooters in the service centre.

   (e) The average waiting time in the queue.

   (f) The average time spent by a scooter in the system.

Or

20. A number of customers approaching a tailor appear to be Poisson distributed with a mean of 6 customer per hour. The tailor attends the customer on a first-come first served basis and the customers wait if the need be the tailor can attend the customers at an average rate of 10 customer per hour with the service time exponentially distributed.

   Determine :

   (a) The probability that the queueing system is idle.

   (b) The average time that the tailor is free on a 10 hour working day.

   (c) What is the expected number of customers in the tailor shop ?

   (d) What is the expected number of customers waiting for the tailor's services ?

   (e) How much time should a customer expect to spend in the queue ?

   (f) What is the expected time a customer would spend in the tailor's shop ?

   (5 × 12 = 60 marks)

F 7794   (Pages : 4)   Reg. No.............................

Name.............................

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Fifth Semester

Branch : Computer Science and Engineering / Information Technology

EN 010 501-B—ENGINEERING MATHEMATICS—IV (CS, IT)

(New Scheme—2010 Admission onwards)

[Supplementary]

Time : Three Hours   Maximum : 100 Marks

Part A

Answer all questions.
Each question carries 3 marks.

1. State Newton's formula on interpolation.

2. Explain the convolution property and its practical significance for z-transforms.

3. Using generating function prove that :

$$P_n(0) = \begin{cases} (-1)^{n/2} \dfrac{1.3.5 \ldots (n-1)}{2.4.6 \ldots n}, & n \text{ is even} \\ 0, & \text{when } n \text{ is odd} \end{cases}$$

4. Expand cos z in a Taylor's series about $z = \pi/4$.

5. Explain briefly :

   (a) Arrival rate.

   (b) Departure rate ; and

   (c) Traffic intensity.

   (5 × 3 = 15 marks)

Part B

Answer all questions.
Each question carries 5 marks.

6. Using Simpson's $1/3$ rule evaluate $\displaystyle\int_0^1 \dfrac{dx}{1 + x^2}$, dividing [0 1] into 6 equal parts.

Turn over

7. Find the z-transform of $(t + T) e^{-(t+T)}$.

8. Find the particular solution for the difference equation $a_r + 5a_{r-1} + 6a_{r-2} = 3r^2 - 2r + 1$.

9. Find the residue at the pole $z = 2$ for the function $\dfrac{z+4}{(z-1)^2 (z-2)^3}$.

10. A mobile phone repairman finds that the time spent on his jobs has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they came in, and if the arrival of sets is approximately Poisson with an average rate of 10 per 8 hour day, what is the repairman's expected idle time each day ? How many jobs are ahead of the average set just brought in ?

$(5 \times 5 = 25 \text{ marks})$

Part C

Answer all questions.
Each full question carries 12 marks.

11. (a) By using Newton's divided difference interpolation formula, find $f(9)$ given the following table of values :

x	:	5	7	11	13	17
$f(x)$	:	150	392	1452	2566	5202

(b) From the following table, estimate the number of students who obtained marks between 40 and 45 :

Marks	:	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
No. of students	:	31	42	51	35	31

Or

12. (a) From the following table of corresponding values of x and y, find y' and y'' at $x = 1.6$.

x	:	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y	:	7.986	8.403	8.781	9.129	9.451	9.750	10.031

(b) A rocket is launched from the ground. Its acceleration registered during 80 seconds is given below. By Simpson's $\frac{1}{3}$ rule find the velocity at $t = 80$ seconds :

t (sec)	:	0	10	20	30	40	50	60	70	80
Acceleration (cm./sec^2)		30	31.63	33.34	35.47	37.75	40.33	43.25	46.69	50.67

13. (a) Find the inverse z-transform of $\dfrac{2\left(z^2 - 5z + 6.5\right)}{(z-2)(z-3)^2}$ for $2 < |z| < 3$.

(b) Solve $y_{n+2} + 4y_{n+1} + 3y_n = 3^n$ with $y_0 = 0, y_1 = 1$.

Or

14. (a) Use convolution theorem to find the inverse z-transform of $\dfrac{8z^2}{(2z-1)(4z+1)}$.

(b) Find the inverse z-transform of $X(Z) = \dfrac{2z^2 + 4z}{4z^2 - 4z + 1}$ $|z| > \frac{1}{2}$ using partial fraction expansion method.

15. (a) Determine the discrete numeric function corresponding to the generating function
$A(z) = \dfrac{1}{1 - z^3}$.

(b) Solve the recurrence relation :
$a_r + 6a_{r-1} + 9a_{r-2} = 3$, given $a_0 = 0, a_1 = 1$.

Or

16. (a) Solve $a_r - 5a_{r-1} + 6a_{r-2} = 2^r + r$ $(r \geq 2)$ given that $a_0 = 1$ and $a_1 = 1$, using the generating functions.

(b) Obtain the generating function of the sequence 1, 0, 1, 0, 1, ... and generate the sequence for the function $f(x) = (2x - 3)^3$.

17. (a) Using Cauchy's integral formula evaluate $\displaystyle\int_C \dfrac{4 - 3z}{z(z-1)(z-2)}\, dz$ where C is the circle $|z| = \frac{3}{2}$.

(b) Apply residue theorem and hence evaluate $\displaystyle\int_C \dfrac{dz}{z^2\left(z^2 + 4\right)}$ where C is the circle $|z - 2i| = 3$.

Or

Turn over

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Fifth Semester

Branch : Computer Science and Engineering

CS 010 504—DIGITAL SIGNAL PROCESSING [CS]

(New Scheme—2010 Admission onwards)

[Improvement/Supplementary]

Time : Three Hours   Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 marks.

1. Define stability is LTI system.

2. What is zero padding ? What are its uses ?

3. Explain Gibb's phenomenon.

4. Write a short note on warping effect.

5. Explain Doppler Effect.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 marks.

6. Check wether the system given by $y(n) = x(-n+2)$ is linear.

7. Compute the DFT of a sequence $(-1)^n$ for N = 4.

8. Explain Fourier receiver method of FIR filter design.

9. Realize the following UR system by cascade forms :

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

10. Briefly explain various image compression techniques.

(5 × 5 = 25 marks)

Turn over

Part C

Answer all questions.
Each full question carries 12 marks.

11. (a) State and explain the properties of z-transform.

(6 marks)

(b) Find the z-transform of the following signal :—

$$x(n) = n \, \alpha^n \, u(n).$$

(6 marks)

Or

12. (a) Define an LTI system. What is the causality condition for an LTI system.

(5 marks)

(b) Show the following systems are non-linear and time invariant :—

(i) $y(n) - x(n)(n-1) = x(n)$

(ii) $y(n+2) + 2y(n) = x(n+1) + 2.$

(7 marks)

13. Compute the DRT of a sequence $x(n) = \{1, -1, 1, -1\}$ using DIT algorithm.

Or

14. Find the circular convolution of the two sequences

$$x_1(n) = \{1, 2, 2, 1\} \; ; \; x_2(n) = \{1, 2, 3, 1\}$$

Using matrix method.

15. What is a Kaiser Window ? Explain the procedure of designing an FIR filter using the Kaiser Window ?

Or

16. (a) Give the cascaded realization of FIR filter structure with complete zeros.

(6 marks)

(b) Realize the following system with minimum no. of multiplies.

$$H(z) = 1 + \frac{1}{3} z^{-1} + \frac{1}{4} z^{-2} + \frac{1}{4} z^{-3} + \frac{1}{3} z^{-4} + z^{-5}.$$

(6 marks)

17. Explain in detail the different types of structures for realization of IIR system with examples.

Or

18. (a) Give direct form I and direct form II structure of second order system realization.

(6 marks)

(b) For the analog transfer function $H(s) = \dfrac{2}{(s+1)(s+2)}$ determine $H(z)$ using impulse invariant method. Assume T = 1 sec.

(6 marks)

19. What are the applications of DSP ? Explain any *one* application in detail with suitable diagrams.

Or

20. Explain the terms :

(a) Subband coding.

(b) VO coder.

(4 marks)

(c) TMS 320 Cx.

(4 marks)

(4 marks)

[5 × 12 = 60 marks]