M.Sc. ELECTRONICS
FOURTH SEMESTER
OPTOELECTRONICS AND SIGNAL & SYSTEMS
MSE-402
(Use separate answer scripts for Objective & Descriptive)

Duration : 3 hrs.   Full Marks : 70

(PART-A : Objective)

Time : 20 min.   Marks : 20

Choose the correct answer from the following: *1x20=20*

1. A periodic signal x(n) of period N_1 is added to another periodic signal of period N_2. Then the period of the resulting signal is always:
   a. N_1+N_2 b. $N_1 N_2$
   c. LCM of N_1 and N_2 d. GCD of N_1 and N_2

2. The area under a impulse function $\partial(t)$ is:
   a. Infinity   b. Unity
   c. 0   d. Undefined

3. Which among the following is a key process adopted for the laser beam formation as it undergoes the light amplification?
   a. Spontaneous emission   b. Stimulated emission
   c. Both a and b   d. None of these

4. The z-transform of x(n)=[4(2)n]u(n) is:
   a. $4/(1-2z^{-1})$ b. $4/(1+2z^{-1})$
   c. $4/(1-z^{-1})$ d. $1/(1-2z^{-1})$

5. The system y(n)=x(3t-6) is:
   a. Anti-Causal and time invariant   b. Causal and time invariant
   c. Causal and invariant   d. Anti-Causal and invariant

6. Given x(n) =$a^{|n|}$, a<1 is
   a. An energy signal   b. Power signal
   c. Neither energy nor power signal d. Energy as well as power signal

7. To obtain x(4-2n) from the given signal x(n), the following precedence (or priority) rule is used for operations on the independent variable n:
   a. Time scaling-> time shifting->reflection.
   b. Reflection -> time shifting-> time scaling.
   c. Time scaling->reflection-> time shifting.
   d. Time shifting-> time scaling->reflection.

8. DTFT is periodic with period:
   a. $\prod$ b. $2\prod$
   c. $\prod/2$ d. $\prod/4$

9. For a system with input x(n)=∂(n-1) and impulse response h(n)= ∂(n+1), the output is:
   a. ∂(n)   b. ∂(n-1)
   c. ∂(n+1)   d. ∂(n+2)

10. Convolution of two odd functions is _____ function.
   a. A odd
   b. An even
   c. Complex
   d. real

11. Periodic signals are:
   a. $X(t+T)=x(t)$
   b. $X(t-T)=x(t)$
   c. $X(n=mN)=x(n)$
   d. All of the above

12. Any signal $x(t)$ can be represented as:
   a. $X_e(t) + X_o(t)$
   b. $X_e(t)-X_o(t)$
   c. $X_e(t)*X_o(t)$
   d. $X_e(t)/ X_o(t)$

13. Given a unit step function $u(t)$. Its time derivative is:
   a. A unit impulse
   b. Another step function
   c. A unit ramp function
   d. A sine function

14. Using frequency shifting property $F[x(t)e^{j\Omega t}]$ is equal to:
   a. $X[j(\Omega-\Omega_o)]$
   b. $X[j(-\Omega_o)]$
   c. $X[j(\Omega+\Omega_o)]$
   d. $X[j(\Omega_o)]$

15. If $x(t)$ is even then $X(j\Omega)$:
   a. Imaginary and even
   b. Imaginary and odd
   c. Real and even
   d. Real and odd

16. The inverse Fourier Transform of $F(j\Omega)= (1/ j\Omega)+\Pi\partial(\Omega)$:
   a. $\sin\Omega t$
   b. $\cos\Omega t$
   c. $Sgn(t)$
   d. $u(t)$

17. The DFT of $x^*(n)$ is:
   a. $X^*(k)$
   b. $X^*(-k)$
   c. $X^*(N-k)$
   d. $X^*(N+k)$

18. The Laplace Transform of $tu(t)$:
   a. $1/s$
   b. $1/s^2$
   c. $2/s^2$
   d. $1/s^3$

19. The DFT of the sequence $x(n)=\partial(n-n_o)$ is:
   a. 1
   b. $e^{j2\Pi kn_o}$
   c. $e^{-(j2\Pi kn_o/N)}$
   d. $e^{(j2\Pi kn_o/N)}$

20. The z-transform of $u(n)$:
   a. $1/1-z^{-1}$
   b. 1
   c. $1/ z^{-1}-1$
   d. $z^{-1}-1$

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(PART-B : Descriptive)

Time : 2 hrs. 40 min.   Marks : 50

[Answer question no.1 & any four (4) from the rest]

1. Check whether or not the system is linear, time invariant, causal, memory less or stable.   10
   $Y(t)= x(t-2) + x(2-t)$

2. a. Name and explain three conditions necessary for lasing action.   5+5=10
   b. How does spontaneous emission occur?

3. a. What is the difference between a surface emitting LED and edge emitting LED?   4+6=10
   b. Name the techniques of coupling light from an LED into an optical fiber with suitable diagram.

4. a. Find whether the following signals are periodic or not.   6+4=10
      (i) $\cos (\Pi n)$ (ii) $e^{j2\Pi/3 n}+ e^{j3\Pi/4 n}$ (iii) $e^{j6\Pi n}$
   b. Find the even and odd components of the following signals
      (i) $\{-2,1,2,-1,3\}$ (ii) $\cos t + \sin t + \cos t \sin t$

5. a. Find the linear and circular convolution of the sequences: 5+5=10
      $x_1(n)=\{1,-1,2,3\}$ and $x_2(n)=\{1,-2,3,-1\}$
   b. Find the Fourier transform of the following:
      (i) $x(n)=a^n u(n)$ (ii) $x(n)= \partial(n+2)- \partial(n-2)$

6. a. Find the Fourier transform and sketch the magnitude and phase spectrum.   8+2=10
      $x(t)= e^{2t}u(t)$
   b. Explain the condition required for existence of Fourier transform.

7. a. Find IDFT of the sequence.   N=4(given)   10
      $X(k)= \{8,2-j,3,2+j\}$

8. a. Find the Z-transform of $x(n)= (0.5)^n u(n) + (0.33)^n u(n)$.   5+5=10
   b. Obtain the direct form II realization of the following sequence:
      $y(n)= -0.1y(n-1)+0.2y(n-2)+3x(n)+3.6x(n-1)+0.6x(n-2)$

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