(PART-B : Descriptive)

Time : 2 hrs. 40 min. Marks : 50

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

1. A bag contains 8 white and 6 red balls. Find the probability of drawing 2 red balls of the same colour. A bag contains 5 red and 10 black balls. Now eight of these balls are placed in another bag. What is the probability that the new ball contains 2 Red and 6lack balls? 5+5=10

2. Find the Laplace transform of $t^2 e^{-t} cost$ and $\frac{1-e^{-t}}{t}$. 5+5=10

3. Prove that the area of the triangle whose vertices are A, B, C is $\frac{1}{2}[B \times C + C \times A + A \times B]$ Also, calculate the area of the triangle whose vertices are A(1,0,-1), B(2,1,5) and C(0,1,2). 5+5=10

4. Find the Fourier transform of $f(x) = 1, |x| < 1$ $= 0, |x| > 1$ 6+4=10

   Also evaluate $\int_0^\infty \frac{\sin s}{s} ds$.

5. Let F(t) have period T>0 so hat F(t+T)=F(t), then 5+5=10
   $L\{f(t)\}=\frac{\int_0^\infty e^{-st} F(t)dt}{1-e^{-st}}$. Show that
   $$L\{sinat - at\,cosat\} = \frac{2a^3}{(s^2+a^2)}$$

6. If A=4I+3J+K, B=2I+3J+K, B=2I-J+2K, find a unit vector N perpendicular to vectors A and B such that A, B, N form a right handed system. Also, find the angle between the vectors A and B. 5+5=10

7. Find the Z transform of: 5+5=10
   $\sin(3n+5)$ and $3n - 4\sin\frac{n\pi}{4} + 5x$

8. A pair of dice is tossed twice. Find the probability of scoring 7 points once, atleast once, twice. Also, given P(A)=1/4, P(B)=1/3, and P(AUB)=1/2, evaluate P(A/B), P(B/A), P(AUB) and P(A/B'). 2+2+2+1+1+1+1=10

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M.Sc. ELECTRONICS
FIRST SEMESTER
APPLIED MATHEMATICS
MSE-101

(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. The Laplace transform of t^n is:
   a. $\frac{n}{s}$ b. $\frac{n!}{s^{n+1}}$
   c. $\frac{n!}{s^{n-1}}$ d. None of them

2. The Z transform of n^p, p being a positive integer:
   a. $-z\frac{d}{dz}Z(n^{p-1})$ b. $z\frac{d}{dz}Z(n^{p+1})$
   c. z d. np

3. If $Z(u_n) = U(z)$, then we have:
   a. $Z(a^{-n}u_n) = U(az)$ b. $Z(a^{-n}u_n) = U(1)$
   c. $Z(a^{-n}u_n) = U(z/a)$ d. $Z(a^{-n}u_n) - U(a)$

4. The Laplace Transform of sin(at) is:
   a. 1 b. $\frac{a}{s^2+a^2}$
   c. $\frac{s}{s^2+a^2}$ d. 0

5. The value of n_{p_r} is:
   a. n_{c_r} b. $n_{c_r} r!$
   c. $n_{c_r} r^2$ d. None of these

6. The number of permutations of all the letters of the word ENGINEERING:
   a. 36250 b. 277200 c. 297840 d. 7666340

7. The mean and standard deviation of a binomial distribution is:
   a. n - p and npq b. np and npq
   c. np and $\sqrt{npq}$ d. None of these

8. The inverse Laplace transform of $\frac{1}{s}$
   a. 1 b. 0 c. 2 d. None of these

9. The integral transform of a function f(x) denoted by I[f(x)], is defined by:

a. $\overline{f(s)} = \int_{x_1}^{x_2} f(x)K(s,x)dx$

b. $f(s) = 1$

c. $\overline{f(s)} = -\int_{x_1}^{x_2} f(x)K(s,x)dx$

d. None of these

10. The Z transform of $(n+1)^2$ is:

a. $\dfrac{Z}{Z-1}$

b. $\dfrac{z^2(2Z+1)}{(z-1)^3}$

c. $\dfrac{z^2(2Z)}{(z-1)^2}$

d. z

11. If $r = \sin t\, i + \cos t\, j + tk$, then $\left|\frac{dr}{dt}\right|$ is:

a. $\sqrt{3}$

b. 4

c. $\sqrt{2}$

d. 1

12. If f and g are two scalar point function, then $f\Delta g + g\Delta f$ is:

a. $\nabla.(fg)$

b. $\nabla \times (fg)$

c. $\nabla(fg)$

d. $f\Delta g$

13. A vector V is said to be solenoidal:

a. Div V= 1

b. curl V=0

c. curl v =1

d. div V=0

14. A vector f is said to be irrotational if:

a. $\nabla.f = 0$

b. $\nabla \times f = 0$

c. $\nabla f = 0$

d. None of these

15. Suppose V is the volume bounded by a closed piecewise smooth surface S. Suppose $F(x,y,z)$ is a vector function of position which is continuous and has continuous first partial derivatives in V. Then, $\iiint_V \nabla.F dv = \iint_s F.nds$ where n is the outward drawn unit normal vector to S is:

a. Green's Theorem

b. Divergence theorem of Gauss

c. Hermite's formula

d. Gradient

16. The value of Z(1) is:

a. $\dfrac{Z}{Z-1}$

b. $\dfrac{Z}{Z-2}$

c. Z

d. None of these

17. A function F(x) in Fourier series is even if:

a. $\int_{-l}^{l} F(x)dx = 0$

b. $\int_{-l}^{l} F(x)dx = 2$

c. $\int_{-l}^{l} F(x)dx = \int_{0}^{l} F(x)dx$

d. $\int_{-l}^{l} F(x)dx = 2\int_{0}^{l} F(x)dx$

18. The function F(x) is called the inverse Fourier sine transform of $f_s(s)\ i.e$ $F(x) = F_s^{-1}\{f_s(s)\}$ is equal to:

a. $\frac{2}{\pi}\int_0^\alpha f_s(s)\sin sx ds$

b. $\frac{\pi}{2}\int_0^\alpha f_s(s)\sin sx ds$

c. $\int_0^\alpha f_s(s)\sin sx ds$

d. None of these

19. The relation between Fourier and Laplace transform is:

a. $F(t) = L^{-1}\{\varphi(t)\}$

b. $L\{\varphi(t)\} = F^{-1}\{F(t)$

c. $F\{F(t)\} = L\{\varphi(t)\}$

d. $\varphi(t) = L$

20. The distribution function F(x) of the discrete variate X is defined by:

a. $F(x) - \sum_{i=1}^{x} p(x_i)$

b. $F(x) = 0$

c. $F(x) = 1$

d. None of these

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