REV-00
MSE/05/10 2016/12

M.Sc. ELECTRONICS
First Semester
ENGINEERING MATHEMATICS & STATISTICS
(MSE - 101)

Duration: 3Hrs. **Full Marks: 70**

Part-A (Objective) =20
Part-B (Descriptive) =50

(PART-B: Descriptive)

Duration: 2 hrs. 40 mins. **Marks: 50**

Answer any *four* from *Question no.* 2 to 8
***Question no.* 1 is compulsory.**

1. State Green's Theorem in the plane. If $f = f_1 i + f_2 j + f_3 k$ is a differentiable vector point function, then curl f=$\left(\frac{\partial f_3}{\partial y} - \frac{\partial f_2}{\partial z}\right)i + \left(\frac{\partial f_1}{\partial z} - \frac{\partial f_3}{\partial x}\right)j + \left(\frac{\partial f_2}{\partial x} - \frac{\partial f_1}{\partial y}\right)k$. Evaluate $\int_c F.dr$, where $F = x^2 i + y^3 j$ and curve C is the arc of the parabola $y = x^2$ in the x-y plane from (0,0) to (1,1). (10)

2. Find the Laplace transform of (5+5=10)

   $(a) t^2 e^{-t} cost$ (b) $\frac{1-e^{-t}}{t}$

3. Find the inverse Laplace transform of (5+5=10)

   $(a) \frac{a^2}{s(s+a)^3}$ (b) $log\frac{s-1}{s+1}$

4. (a) Find the Fourier coefficients corresponding to the function

   $F(x) = 0, -5 < x < 0$

   $= 3, 0 < x < 5$, Period = 10

   (b) Find the corresponding Fourier series.

   (c) How should F(x) be defined x=-5, x=0,x=5 in order that the Fourier series will converge to F(x) for -5$\leq x \leq 5$.

   (5+2+3=10)

5. Fin the Fourier integral of $f(x) = e^{-kx}$ where x> $0, k > 0$ and f(-x)=-f(x) and show that $\int_0^{\alpha} \frac{w sinwx}{k^2+w^2} dw = \frac{\pi}{2} e^{-kx}$ and deduce that (6+4=10)

$\int_0^{\alpha} \frac{sinwx}{w} dw = \frac{\pi}{2}$.

6. Write a brief note on Poisson Distribution and mention its applications. If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals more than two will get a bad reaction. (5+5=10)

7. Find the Z transform of (5+5=10)

(a) $\sin(3n + 5)$ (b)$3n - 4sin\frac{n\pi}{4} + 5x$

8. Using convolution theorem evaluate $Z^{-1}\{\frac{z^2}{(z-a)(z-b)}\}$. Show that $Z\left(\frac{1}{n!}\right) = e^{\frac{1}{2}}$

(5+5=10)

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Duration: 20 minutes **Marks – 20**

(PART A - Objective Type)

I. Choose the correct answer: **1×20=20**

1. The Laplace transform of t^n is:
   (i) $\frac{n}{s}$ (ii) $\frac{n!}{s^{n+1}}$ (iii) $\frac{n!}{s^{n-1}}$ (iv) nt
2. The Z transform of n^p, p being a positive integer:
   (i) $-z\frac{d}{dz}Z(n^{p-1})$ (ii) $-z\frac{d}{dz}Z(n^{p+1})$ (iii) z (iv) np
3. If $Z(u_n) = U(z)$, then we have:
   (i) $Z(a^{-n}u_n) = U(az)$ (ii) $Z(a^{-n}u_n) = U(1)$
   (ii) $Z(a^{-n}u_n) = U(z/a)$ (iv) $Z(a^{-n}u_n) = U(a)$
4. If $U(z) = \frac{2z^2+5z+14}{(z-1)^4}$, then u_2 is:
   (i) 1 (ii) 2 (iii) 3 (iv) None of these
5. The value of n_{p_r} is:
   (i) n_{c_r} (ii) $n_{c_r}r!$ (iii) $n_{c_r}r^2$ (iv) None of these
6. The number of permutations of all the letters of the word ENGINEERING is:
   (i) 36250 (ii) 277200 (iii) 297840 (iv) 7666340
7. The mean and standard deviation of a binomial distribution is:
   (i) n – p and npq (ii) np and npq
   (iii) np and $\sqrt{npq}$ (iv) None of these
8. By convolution theorem of Z transformation if $Z^{-1}[U(z)] = u_n$ and $Z^{-1}[V(z)] = v_n$ then $Z^{-1}[U(z)V(z)]$ is equal to
   (i) $u_n * v_n$ (ii) uv (iii) UxV (iv) None of these
9. The probability of r successes in a binomial distribution is
   (i) $P(r) = n_{c_r}p^r q^n$ (ii) $P(r) = n_{c_r}p^r q^{n-r}$
   (iii) $P(r) = n_{c_r}p^{n-r} q^{n-r}$ (iv) $P(r) = n_{c_r}p^r q^r$
10. The Z transform of $(n+1)^2$ is
   (i) $\frac{Z}{Z-1}$ (ii) $\frac{z^2(2Z+1)}{(z-1)^3}$ (iii) $\frac{z^2(2Z)}{(z-1)^2}$ (iv) z

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

(i) $\sqrt{3}$ (ii) 4 (iii) $\sqrt{2}$ (iv) 1

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

(i) $\nabla.(fg)$ (ii) $\nabla \times (fg)$ (iii) $\nabla(fg)$ (iv) $f\Delta g$

13.A vector V is said to be solenoidal if

(i) Div V= 1 (ii) curl V=0 (iii) curl v =1 (iv) div V=0

14. A vector f is said to be irrotational if

(i) $\nabla.f = 0$ (ii) $\nabla \times f = 0$ (iii) $\nabla f = 0$ (iv) None of these

15. Suppose V is the volume bounded by a closed pieciewise 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, $\iiint_V \nabla.Fdv = \iint_s F.nds$ where n is the outward drawn unit normal vector to S is

(i) Green's Theorem (ii) Divergence theorem of Gauss

(iii) Hermite's formula (iv) Gradient

16. For half range cosine series, we have

(i) $a_n = 0, b_n \neq 0$ (ii) $b_n = 0, a_n \neq 0$

(iii) $a_n = 0, b_n = 0$ (iv) None of these

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

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

(ii) $\int_{-l}^{l} F(x)dx = \int_0^l F(x)dx$ (iv) $\int_{-l}^{l} F(x)dx = 2\int_0^l F(x)dx$

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

(i) $\frac{2}{\pi}\int_0^\alpha f_s(s) sinsxds$ (ii) $\frac{\pi}{2}\int_0^\alpha f_s(s) sinsxds$

(iii) $\int_0^\alpha f_s(s) sinsxds$ (iv) None of these

19.The relation between Fourier and Laplace transform is

(i) $F(t) = L^{-1}\{\varphi(t)\}$ (ii) $L\{\varphi(t)\} = F^{-1}\{F(t)\}$

(iii) $F\{F(t)\} = L\{\varphi(t)$ (iv) $\varphi(t) = L$

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

(i) $F(x) = \sum_{i=1}^{x} p(x_i)$ (ii) $F(x) = 0$

(iii) $F(x) = 0$ (iv) $F(x) = \sum_{i=1}^{x} x_i$

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