REV-00
MSE/7/12

2017/12

M. Sc. ELECTRONICS
FIRST SEMESTER
ENGINEERING MATHEMATICS AND STATISTICS
MSE - 101

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

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

[PART-B : Descriptive]

Duration: 2 Hrs. 40 Mins. **Marks: 50**

[Answer question no. One (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 . 5+5=10

A bag contain 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.

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

3. State and prove Green's theorem in a plane 10

4. Find the Fourier transform of $f(x) = 1, |x| < 1$ 4+2+4 =10

$= 0, |x| > 1$

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

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 F=3xyi-$y^2 j$, evaluate $\int_c F.dr$ where C is the curve in the XY plane $y = 2x^2$ from (0,0) t0 (1,2). Find the work done when a force $F = (x^2 - y^2 + x)i - (2xy + y)j$ moves a particle in XY plane from (0,0) to (1,1) along the parabola $y^2 = x$. 5+5=10

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

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

8. If $f = f_1 i + f_2 j + f_3 k$ is a differentiable vector point function, then 5+5=10

curl f=$(\frac{\partial f_3}{\partial y} - \frac{\partial f_2}{\partial z})i + \left(\frac{\partial f_1}{\partial z} - \frac{\partial f_3}{\partial x}\right)j + \left(\frac{\partial f_2}{\partial x} - \frac{\partial f_1}{\partial y}\right)k.$

Apply Divergence theorem to evaluate

$\iint_S [(x+z)dydz + (y+z)dxdz + (x+y)dxdy]$ where S is the surface of the sphere $x^2 + y^2 + z^2 = 4$

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[PART-A : Objective]

Choose the correct answer from the following : 1×20=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. If $U(z) = \frac{2z^2+5z+14}{(z-1)^4}$, then u_2 is
   a. 1
   b. 2
   c. 3
   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. 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
   a. $u_n * v_n$
   b. uv
   c. U x v
   d. None of these

9. The probability of r successes in a binomial distribution is
   a. $P(r) = n_{c_r}p^r q^n$
   b. $P(r) = n_{c_r}p^r q^{n-r}$
   c. $P(r) = n_{c_r}p^{n-r} q^{n-r}$
   d. $P(r) = n_{c_r}p^r q^r$

10. The Z transform of $(n+1)^2$ is
   a. $\frac{Z}{Z-1}$
   b. $\frac{z^2(2Z+1)}{(z-1)^3}$
   c. $\frac{z^2(2Z)}{(z-1)^2}$
   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 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, $\iiint_V \nabla . F dv = \iint_s F . n ds$ 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. For half range cosine series, we have

a. $a_n = 0, b_n \neq 0$

b. $b_n = 0, a_n \neq 0$

c. $a_n = 0, b_n = 0$

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. $\frac{2}{\pi}\int_{0}^{\alpha} f_s(s) sinsxds$

b. $\frac{\pi}{2}\int_{0}^{\alpha} f_s(s) sinsxds$

c. $\int_{0}^{\alpha} f_s(s) sinsxds$

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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UNIVERSITY OF SCIENCE & TECHNOLOGY, MEGHALAYA

[PART (A) : OBJECTIVE]

Duration : 20 Minutes

Serial no. of the main Answer sheet

Course : ....

Semester : .... **Roll No :** ....

Enrollment No : .... **Course code :** ....

Course Title : ....

Session : 2017-18 **Date :** ....

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Instructions / Guidelines

- The paper contains twenty (20) / ten (10) questions.
- Students shall tick (✓) the correct answer.
- No marks shall be given for overwrite / erasing.
- Students have to submit the Objective Part (Part-A) to the invigilator just after completion of the allotted time from the starting of examination.

Full Marks	Marks Obtained
20	

Scrutinizer's Signature   *Examiner's Signature*   *Invigilator's Signature*