REV-00
MSE/09/19 2015/12

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 *five* of the following questions:

1. Define Z-transform and inverse Z-transform. If $Z[\{f(k)\}]=F(z)$, then prove $Z[\{kf(k)\}]=-z\frac{d}{dz}F(z)$ and $Z\left[\left\{\frac{f(k)}{k}\right\}\right]=-\int_z z^{-1}F(z)dz$. (1+1+4+4=10)

2. Define Laplace transform and find Laplace transform of $t\sin 2t$. If $L[f(t)]=F(s)$, then prove $L\left[\frac{1}{t}f(t)\right]=\int_s^{\infty}F(s)ds$. (2+3+5=10)

3. Define Fourier series and write any two advantages of Fourier series. Find a Fourier series to represent, $f(x)=\pi-x$ for $0<x<2\pi$. (2+2+6=10)

4. State and prove the shifting property and convolution theorem for the Fourier transform. (3+7=10)

5. Define Scalar point function and vector point function. Find grad$f$, where $f=\log(x^2+y^2+z^2)$. If $\vec{r}=xi+yj+zk$ is a vector where $|\vec{r}|=r$ then show that the vector $r^n\vec{r}$ is irrotational. (2+3+5=10)

6. Using Stoke's theorem evaluate $\int\left[(2x-y)dx-yz^2dy-y^2zdz\right]$ where c is the circle $x^2+y^2=1$, corresponding to the surface of unit radius. Verify Green's theorem for $\int_c[(x^2+2xy)dx+(y^2+x^3y)dy]$ where C is a square with the vertices (0, 0), (1, 0), (1, 1) and (0, 1). (5+5=10)

7. Define conditional probability. If the events A and B defined on a sample space S of a random experiment are independent, then show that $P(A/B)=P(A)$ and $P(B/A)=P(B)$. State and prove Bayes theorem. (1+2+7=10)

8. Prove the Poisson distribution, $P(r)$ is $P(r)=\frac{m^r e^{-m}}{r!}$. Find the mean of Poisson distribution. (5+5=10)

*****

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

Duration: 20 minutes **Marks – 20**

(PART A - Objective Type)

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

1. The value of Curl(grad f) is
   (a) 0 (b) 1 (c) grad$f$ (d) Curl$f$

2. The value of grad f is
   (a) 0 (b) 1 (c) Curl(grad$f$) (d) ∇f

3. The value of div(Curl v) is
   (a) 0 (b) 1 (c) div v (d) Curl$v$

4. The value of div(grad f) is
   (a) ∇f (b) $\nabla^2 f$ (c) $\nabla^3 f$ (d) $\nabla^4 f$

5. In a scalar point function $\phi(x,y,z)$, every point in space is
   (a) a scalar (b) a vector
   (c) scalar or vector (d) none of these

6. Gradφ is a vector to the surface $\phi(x,y,z)=c$ which is
   (a) perpendicular (b) normal
   (c) may be perpendicular (d) none of these

7. Curl of a vector point function is a
   (a) scalar quantity (b) vector quantity
   (c) some time scalar (d) some time vector

8. The field termed irrotational if
   (a) $Div\overline{F}=0$ (b) $Div\overline{F}=1$
   (c) $Curl\overline{F}=0$ (d) $Curl\overline{F}=1$

9. For any two functions f and g, $\nabla(fg)$ is
   (a) $\nabla(f+g)$ (b) $\dfrac{g\nabla f+f\nabla g}{g^2}$
   (c) $f\nabla g+g\nabla f$ (d) none of these

10. Which is of the following is a periodic function?

(a) $\sin x + x$ (b) $\sin x + 2x$

(c) $\sin x + 3x$ (d) $\sin x$

11. $\int_0^{2\pi} \sin nx dx = ?$

(a) π (b) $\frac{\pi}{2}$ (c) 0 (d) 1

12. $\int_0^{2\pi} \sin nx . \cos nx dx = ?$

(a) π (b) $\frac{\pi}{2}$ (c) 0 (d) 1

13. If $f(t)=1$, then $L[f(t)] = ?$

(a) $\frac{1}{s}$ (b) s (c) $\frac{1}{s-a}$ (d) 1

14. The value of $L^{-1}(\frac{1}{s-a})$ is

(a) $\frac{1}{s}$ (b) s (c) e^{at} (d) e^{-at}

15. Fourier sine transform of $f(x)$ is

(a) $F(s) = \int_0^{\infty} f(t) \sin st dt$ (b) $F(s) = \sqrt{\pi} \int_0^{\infty} f(t) \sin st dt$

(c) $F(s) = \sqrt{\frac{\pi}{2}} \int_0^{\infty} f(t) \sin st dt$ (d) $F(s) = \sqrt{\frac{2}{\pi}} \int_0^{\infty} f(t) \sin st dt$

16. The value of $P(\varphi)$ is

(a) 0 (b) 1 (c) 0.05 (d) 0.9

17. If A and B are two mutually exclusive events then

(a) $\frac{P(A \cup B)}{P(A)} = 0$ (b) $\frac{P(A \cup B)}{P(A)} = P(A/B)$

(c) $P(A \cap B) = 0$ (d) $\frac{P(A \cap B)}{P(A)} = P(A/B)$

18. If A and B are not mutually not exclusive events then which of the following is true

(a) $\frac{P(A \cup B)}{P(A)} = 0$ (b) $\frac{P(A \cap B)}{P(A)} = P(A/B)$

(c) $P(A \cap B) = 0$ (d) $\frac{P(A \cap B)}{P(B)} = P(A/B)$

19. If A and B are any two independent events then $P(AB)$ is equal to

(a) $P(A)P(B)$ (b) $\frac{P(B)}{P(A)}$ (c) $\frac{P(A)}{P(B)}$ (d) $P(B)$

20. A bag contains 7 red and 8 black balls. Then the probability of drawing a red ball is

(a) 15 (b) $\frac{8}{15}$ (c) $\frac{7}{15}$ (d) $\frac{15}{8}$

*****