AU – 2507

Third Semester B. E. (Electronics and Telecommunication) (CGS) Examination

MATHEMATICS – III

Paper – 3 XT 01/3 IE 01/3 XN 01

(USC – 10591)

P. Pages : 5

Time : Three Hours] [Max. Marks : 80

Note : (1) Answer **Three** questions from Section A and **Three** questions from Section B.
(2) Use of calculator and Normal distribution table is permitted.
(3) Use pen of Blue/Black ink/refill only for writing the answer book.

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SECTION A

1. (a) Solve :

$$(D^2 + 5D + 6)y = e^{-2x}.\ \sec^2 x(1 + 2.\tan x)$$ 7

(b) Solve by method of variation of parameters :

$$(D^2 - 1)y = (1+e^{-x})^{-2}$$ 6

OR

2. (a) Solve :

$$(D^2 - 2D + 4)^2 y = xe^x.\ \cos(\sqrt{3}x + \alpha)$$ 7

(b) Solve :

$$(x^3D^3 + x^2D^2 - 2)y = x + \frac{1}{x^3}$$ 6

3. (a) Use fundamental definition, to find Laplace transform of :

$$f(t) = \sin 2t \quad , \quad 0 < t < \pi$$
$$= 0 \quad ; \quad t > \pi$$ 4

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(b) Find inverse Laplace transform of

$$\frac{S^2 - 3}{(S+2)(S-3)(S^2+2S+5)}$$ 5

(c) Solve by Laplace transform

$(D^2 + 2D + 1)y = 3te^{-t}$

$y(0) = 4 \quad , \; y'(0) = 2$ 5

OR

4. (a) Obtain the inverse Laplace transform of :

$$\frac{e^{-\pi s}}{S^2+4}$$ 4

(b) Find the Laplace transform of periodic function :

$f(t) = \dfrac{kt}{T} \quad , \; 0 < t < T$

and $f(t) = f(t + T)$. 5

(c) Solve the simultaneous equations :

$$\frac{dx}{dt} = 2x - 3y$$

$$\frac{dy}{dt} = y - 2x$$

Subject to $x(0) = 8$., $y(0) = 3$ 5

5. (a) Solve the following difference equations :

(i) $u_{n+2} - 2u_{n+1} + 4u_n = 6$ 4

(ii) $y_{n+2} - 4y_n = n^2 + n - 1$ 4

(b) Find z–transform of :

$$\frac{(n+1)(n+2)}{2!} \cdot a^n$$ 5

OR

6. (a) Solve the difference equation :

$$8y_{n+2} - 6y_{n+1} + y_n = 5.\sin\frac{n\pi}{2}$$ 5

(b) Find z–transform of :

$\sin(3n+5)$ 3

(c) Solve by z–transform

$$y_{n+2} + 2y_{n+1} + y_n = n$$

given that $y_0 = y_1 = 0$ 5

SECTION B

7. (a) Using fourier integral, show that

$$\int_0^{\infty} \frac{\sin\pi\lambda\,.\,\sin\lambda x}{1-\lambda^2} = \frac{\pi}{2}\sin x, \quad 0 \leq x \leq \pi$$

$$= 0 \qquad x > \pi$$ 5

(b) Solve

$$x\frac{\partial z}{\partial y} = y\frac{\partial z}{\partial x} + x.e^{x^2+y^2}$$ 4

(c) If the probability that the individual suffers a bad reaction from a certain injection is 0.001. Determine the probability that out of 2000 individuals:

(i) Exactly 3

(ii) More than 2

Individuals will suffer a bad reaction. 5

OR

8. (a) Find the fourier sine transform of e^{-x}, $x \geq 0$ and show that :

$$\int_0^{\infty} \frac{x.\sin mx}{(x^2+1)}dx = \frac{\pi}{2}\,.\,e^{-m}, \quad m > 0$$ 6

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(b) Solve :

$$pq = x^m y^n z^{2l}$$ 4

(c) Fit a Binomial distribution for the given data :

x :	0	1	2	3	4	5
y :	2	14	20	34	22	8

4

9. (a) If f(z) is analytic function with constant amplitude then prove that f(z) is constant. 6

(b) Under the transformation $w = \frac{z-1}{z+1}$ show that the mapping of the straight line $x = y$ is a circle and find its centre and radius. 7

OR

10. (a) Expand :

$$\frac{z^2-6z-1}{(z-1)(z-3)(z+2)}$$

in $3<|z+2|<5$ 7

(b) Evaluate :

$$\oint_c \frac{\cos \pi z^2}{(z-1)(z-2)} dz \; ; \; c : |z| = 3$$ 6

11. (a) Find the directional derivative of $f(x, y, z) = x^2y^2z^2$ at the point $(1, 1, -1)$ in the direction of the tangent to the curve $x = e^t$, $y = 2 \sin t + 1$, $z = 1-\cos t$ at $t = 0$ 6

(b) Use Divergence theorem to evaluate

$\iint_S \bar{F} \cdot d\bar{s}$, where $\bar{F} = 4x\hat{i} - 2y^2\hat{j} + z^2\hat{k}$ and S is the surface bounding the region $x^2+y^2=4$, $z=0$ and $z=3$. 7

OR

12. (a) If $\phi_1 = x+y+z$, $\phi_2 = x+y$ and $\phi_3 = -(2xz+2yz+z^2)$

Show that :

$$\nabla\phi_1 \cdot \{\nabla\phi_2 \times \nabla\phi_3\} = 0$$ 6

(b) Show that the vector field

$$\bar{F} = (y\sin z - \sin x)\hat{i} + (x \sin z + 2yz)\hat{j} + (xy\cos z + y^2)\hat{k}$$

is irrotational and find the corresponding scaler ϕ such that $\bar{F} = \nabla\phi$. 7

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