23.01.2023 (E)

SOMAIYA
VIDYAVIHAR UNIVERSITY

Maximum Marks: 100	Semester: August 2022 – December 2022 (Jan-2023) Examination: ESE Examination DSY (Regt KT)		Duration: 3 Hrs.
Programme code: 03 Programme: B.TECH		Class: SY	Semester: III(SVU 2020)
Name of the Constituent College: K. J. Somaiya College of Engineering		Name of the department: EXTC	
Course Code: 116U03C301	Name of the Course: Mathematics for Communication Engineering-I		
Instructions: 1)Draw neat diagrams 2) All questions are compulsory 3) Assume suitable data wherever necessary			

Que. No.	Question	Max. Marks
Q1	Solve any **Four** of the following.	**20**
i)	Find inverse Laplace transform of $\frac{3s+7}{s^2-2s-3}$	5
ii)	Find half range Cosine series of $f(x) = x$ in(0,2).	5
iii)	Using Laplace transform evaluate $\int_0^\infty e^{-t} \int_0^t usinu\, dudt$	5
iv)	Prove that $J_{\frac{-3}{2}}(x) = -\sqrt{\frac{2}{\pi x}}(\frac{\cos x}{x} + \sin x)$	5
v)	Find the direcational derivaties of $\emptyset = xy + yz + xz$ at (1,2,1) along the normal to surface $x^2 + y^2 = z + 4$ at $(1,1,-2)$	5
vi)	Evaluate $\int_c \bar{F}.d\bar{r}$ where $\bar{F} = x^2 i + xyj$ and C is the straight line joining O(0,0) to A(1,1).	5
Q2 A	Solve the following.	**10**
i)	Find Laplace transforms of $te^{-3t}cos2t$	5
ii)	Find inverse laplace transform of $log\left(\frac{s^2+1}{s(s+1)}\right)$	5
	OR	
Q2 A	Find Fourier Series of $f(x) = e^{-x}$ $0 < x < 2\pi$ Also deduce the value of $\sum_{n=2}^{\infty} \frac{(-1)^n}{n^2+1}$	10
Q 2 B	Solve any **One** of the following.	**10**
i)	Verify Green's Theorem in the plane for $\oint_c [(xy + y^2)dx + x^2 dy]$ Where C is the closed curve of the region bounded by $y = x$ and $x^2 = y$.	10
ii)	Given $\bar{F} = (2xy + z)i + (x^2 + 2yz^3)j + (3y^2z^2 + x)k$, (a)Prove that $\bar{F}$ is conservative (b) Find Scalar potential function $\emptyset$ such that $\bar{F} = \nabla\emptyset$. (c) Find the work done by $\bar{F}$ in moving a particle from $A(1,2,0)$ to $B(2,2,1)$ along the straight line AB. d) Find divergence of $\bar{F}$.	10

Q3	Solve any **Two** of the following.	20
i)	a) Prove that: $4J_n''(x) = J_{n-2}(x) - 2J_n(x) + J_{n+2}(x)$ b) Find the angle between the normals to the surface $xy = z^2$ at the points $(1,4,2)$ and $(-3,-3,3)$.	10
ii)	Solve the following Differential Equation using Laplace transform $(D^2+1)y = t\ , y(0) = 1, y'(0) = 0.$	10
iii)	Find Fourier Series of $f(x) = x^2 \quad -\pi < x < \pi$ and hence deduce that a) $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} \cdots$ b) $\frac{\pi^4}{90} = \frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \cdots$	10
Q4	Solve any **Two of** the following.	20
i)	a) Find $J_2(x), J_3(x), J_4(x)$ in terms of $J_0(x)$ and $J_1(x)$. b) If $\bar{a} = i - 2j - 2k, \bar{b} = 2i + j - k, \bar{c} = i + 3j - 2k, \bar{d} = 2i + j - 3k$, find $(\bar{a} \times \bar{b}).(\bar{c} \times \bar{d})$	10
ii)	Find Fourier series of $f(x) = \begin{cases} \pi x & , \quad 0 \le x \le 1 \\ \pi(2-x) & , \quad 1 \le x \le 2 \end{cases}$ and show that $f(x) = \frac{\pi}{2} - \frac{4}{\pi}\sum \frac{1}{(2n+1)^2}\cos(2n+1)\pi x$	10
iii)	Evaluate by Gauss's Divergence theorem $\iint_s \overline{N}.\bar{F}\, ds$ Where $\bar{F} = 4x\hat{\imath} - 2y^2\hat{\jmath} + z^2\hat{k}$ & S is the region bounded by $x^2 + y^2 = 4$, $z = 0, z = 3$.	10
Q5	Solve any **Four** of the following.	20
i)	Find the Complex form of Fourier Series for $f(x) = 2x$ in $(0,2\pi)$	5
ii)	Using convolution theorem find inverse laplace transform of $\frac{s^2}{(s^2+4)(s^2+9)}$	5
iii)	Prove that $\int J_3(x)dx = -\frac{2}{x}J_1(x) - J_2(x)$	5
iv)	Prove that $\nabla\left[\nabla.\ \frac{\bar{r}}{r}\right] = -\frac{2}{r^3}\bar{r}$.	5
v)	Using Stokes theorem evaluate $\int_c \bar{F}.d\bar{r}$ Where $\bar{F} = 4xz\hat{\imath} - y^2\hat{\jmath} + yz\hat{k}$ and C is the boundary of the area in the plane $z = 0$ bounded by $x = 0, y = 0$ and $x^2 + y^2 = 1$.	5
vi)	Express $f(t) = \begin{cases} sint, & 0 < t < \pi \\ cost, & t > \pi \end{cases}$ as Heaviside's Unit step function and hence find its Laplace Transform.	5