University of Mumbai

Program: BE (CIVIL)

Curriculum Scheme: Rev2019

Examination: SE Semester III

Course Code: CEC301 and Course Name: Engineering Mathematics III

Time: 2 hour 30 minutes Max. Marks: 80

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Find the Laplace transform of f(t), f(t)=a, 0< t <b and f(t)=0, t>b
Option A:	$\frac{ab}{s}(1-e^{-bt})$
Option B:	$\frac{b}{s}(1-e^{-bt})$
Option C:	$\frac{a}{s}(1-e^{-bt})$
Option D:	$\frac{-a}{s}(1-e^{-bt})$
2.	Find the Laplace transform of $e^{4t}.\sin^3 t$
Option A:	$\frac{6}{(s^2-8s+17)(s^2-8s+25)}$
Option B:	$\frac{64}{(s^2-8s+17)(s^2-8s+25)}$
Option C:	$\frac{6}{(s^2-8s+17)(s^2-8s+20)}$
Option D:	$\frac{6}{(s^2-7s+17)(s^2-8s+25)}$
3.	Find $L^{-1}[\frac{1}{s(s^2+4)}]$
Option A:	$\frac{1}{4}(1-cos2t)$
Option B:	$\frac{1}{45}(1-sin2t)$
Option C:	$\frac{1}{4}(1-Cot2t)$
Option D:	$\frac{1}{4}(1-tan2t)$
4.	Find the Inverse Laplace transform $\frac{1}{s(s+a)}$
Option A:	$\frac{1-e^{-at}}{ab}$
Option B:	$\frac{1-e^{-at}}{a}$
Option C:	$\frac{1-e^{-t}}{a}$
Option D:	$\frac{1-e^{at}}{a}$
5.	Find the value of an for xcosx in (-π, π)
Option A:	1/n
Option B:	0

Option C:	2/n
Option D:	4
6.	Find the Eigenvalue for the given matrix. $A=\begin{bmatrix} 4 & 1 & 3 \\ 1 & 3 & 1 \\ 2 & 0 & 5 \end{bmatrix}$.
Option A:	13
Option B:	-3
Option C:	7.1
Option D:	8.3
7.	Construct an analytic function whose real part is $e^x \cos y$
Option A:	$f(z) = \int e^z . dz = ea^z + c$
Option B:	$f(z) = \int e^z . dz = a^z + c$
Option C:	$f(z) = \int e^z . dz = e^{az} + c$
Option D:	$f(z) = \int e^z . dz = e^z + c$
8.	What is the value of k to solve $\frac{\partial^2 u}{\partial x^2} - 32\frac{\partial u}{\partial t} = 0$ by Bender Schmidt method with h = 0.25 if h & k are the increments of x and t respectively.
Option A:	0.25
Option B:	1
Option C:	0.5
Option D:	0.75
9.	The determinant of the matrix whose eigen values are 4, 2, 3 is given by, _____
Option A:	9
Option B:	24
Option C:	5
Option D:	3
10.	If A is diagonalizable then, _____
Option A:	$A^n = (PDP^{-1})^n = PD^nP^n$
Option B:	$A^n = (PDP^{-1})^n = PD^nP^1$
Option C:	$A^n = (PDP^{-1})^n = PD^nP^{-1}$
Option D:	$A^n = (PDP^{-1})^n = PD^nP$

Q2 **(20 Marks Each)**	**Solve any Four out of Six** **5 marks each**
A	Find the Laplace transform of $\frac{1}{t}e^{-t}sint$
B	Find the inverse Laplace transform of $\frac{1}{\sqrt{2s+1}}$
C	Show that the function, $v = e^{x}(xsiny + ycosy)$ is a harmonic function. Find its harmonic conjugate.
D	Find the Fourier series for f (x)=x in (0,2π).
E	Using Bender- Schmidt method, solve $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$, -subject to the conditions, u(0,t) = 0 , u(4,t) = 0, $u(x, 0) = x^2(16 - x^2)$ taking h =1, for 3 minutes
F	Check if matrix is diagonalizable and find transforming matrix $[4\ 6\ 6\ 1\ 3\ 2\ \ -1\ \ -5\ \ -2]$

Q3 **(20 Marks Each)**	**Solve any Four out of Six** **5 marks each**
A	Find the Laplace transform of $cost\ cos2t\ cos3t$
B	Find the inverse Laplace transform of $\frac{s+2}{s^2(s+3)}$
C	Determine whether the function $f(z) = x^2 - y^2 + 2ixy$ is analytic and if so Find its derivative.
D	Find half range cosine series for $f(x) = x$ in (0,2).
E	Find eigen values of A^2 – 2A + I and adj A Where A = $\begin{bmatrix} 4 & 1 & -1 \\ 6 & 3 & -5 \\ 6 & 2 & -2 \end{bmatrix}$
F	A string is stretched and fastened to two points distance ***l*** apart. Motion is started by displacing the string in the form ***y*** = ***asin***(***πx l***) from which it is released at time t = 0. If the vibration of a string is given by $\partial^2 y/\partial t^2 = c^2 (\partial^2 y/\partial^2 x)$, show that the displacement of a point at a distance x from one end at time t is given by ***y(x,t)*** = ***asin*** (***πx l***) ***cos*** (***πct l***) .

Q4 **(20 Marks Each)**	**Solve any Four out of Six** **5 marks each**
A	Find the Laplace transform of $cos4t\ cos6t$
B	Find the inverse Laplace transform of $\frac{s}{(s^2+9)^2}$
C	Determine whether the function $f(z) = x^2 - y^2 + 2ixy$ is analytic and if so Find its derivative.
D	Find the Fourier series for $f(x) = e^{-\lvert x\rvert}$ in (-π,π).
E	Find Eigen value and Eigen vector of matrix $[2\ \ -1\ 1\ 1\ 2\ \ -1\ 1\ \ -1\ 2]$

F	Solve by Crank Nicholson simplified formula $\frac{\partial^2 u}{\partial x^2} - 16\frac{\partial u}{\partial t} = 0$, u(0,t) = 0, u(1,t) – 200t, u(x,0) = 0 taking h = 0.25 for one time step.