1T00533 - S.E.(Chemical Engineering)(SEM-III)(Choice Base Credit Grading System) (R- 19) (C Scheme) / 50721 - Engineering Mathematics - III

University of Mumbai

Program: Chemical Engineering
Curriculum Scheme: R- 2019 (C-Scheme)
Examination: SE Semester-III

Question Paper Code-50721 Course Name: EM-III
Time: 2 hour DATE: 3/6/2022 QP CODE:90817 Max. Marks: 80

Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Laplace transform of $e^{-2t}\sin t$ is
Option A:	$\frac{1}{(s-2)^2}$
Option B:	$\frac{s}{(s+2)^2}$
Option C:	$\frac{1}{(s+2)^2+1}$
Option D:	$\frac{s}{(s+2)^2+1}$
2.	If $f(z)=u(x,y)+iv(x,y)$ is an analytic function then $f'(z)$ is
Option A:	$\frac{\partial u}{\partial x}+i\frac{\partial v}{\partial x}$
Option B:	$\frac{\partial u}{\partial x}-i\frac{\partial v}{\partial x}$
Option C:	$\frac{\partial v}{\partial y}-i\frac{\partial v}{\partial x}$
Option D:	$\frac{\partial v}{\partial y}+i\frac{\partial v}{\partial x}$
3.	Eigen values of hermitian matrix is always
Option A:	0
Option B:	Purely real
Option C:	Purely imaginary
Option D:	complex
4.	If eigenvalues of a matrix is 1, 2,3 then Eigen values of A^2
Option A:	1,2,3
Option B:	1,4,9
Option C:	1,5,2
Option D:	1,2,6
5.	If $f(z)=\log z$ is an analytic function, then real part is
Option A:	$\tan^{-1}\left(\frac{y}{x}\right)$
Option B:	$\tan^{-1}\left(\frac{x}{y}\right)$
Option C:	$\frac{1}{2}\log(x^2+y^2)$

Option D:	$\log(x^2+y^2)$
6.	The value of b_n in the fourier series of $f(x)=\{\begin{smallmatrix} \cos x\ ; -\pi<x<0 \\ -\cos x\ ;\ \ 0<x<\pi \end{smallmatrix}$ is
Option A:	$\frac{(-1)^n}{n}$
Option B:	$\frac{1}{n}$
Option C:	$\frac{(-1)^n}{n^2-1}$
Option D:	0
7.	The value of Fourier coefficient b_n in expansion of $f(x)=x\sin x$ in $(-1,1)$ is
Option A:	0
Option B:	$\frac{a_n}{2}$
Option C:	$\frac{a_0}{4}$
Option D:	3
8.	Inverse Laplace transform of $\frac{1}{s}$ is
Option A:	t
Option B:	$\frac{\sin t}{t}$
Option C:	1
Option D:	e^1
9.	A linear second order partial differential equation in general is of the form $A\frac{\partial^2 u}{\partial x^2}+B\frac{\partial^2 u}{\partial x\partial y}+C\frac{\partial^2 u}{\partial y^2}+D\frac{\partial u}{\partial x}+E\frac{\partial u}{\partial y}+Fu=G$ where A,B,C,D,E,F,G are functions of x & y then the equation is elliptic if
Option A:	$\Delta= B^2-4AC<0\ at\ any\ point\ (x,y)$
Option B:	$\Delta= B^2-4AC>0\ at\ any\ point\ (x,y)$
Option C:	$\Delta= B^2-4AC=0\ at\ any\ point\ (x,y)$
Option D:	$\Delta= B^2-4AC=1\ at\ any\ point\ (x,y)$
10.	Laplace equation is
Option A:	$\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}$
Option B:	$\frac{\partial^2 y}{\partial t^2}=c^2\frac{\partial^2 y}{\partial x^2}$
Option C:	$\frac{\partial u}{\partial t}=c^2(\frac{\partial^2 u}{\partial x^2}-\frac{\partial^2 u}{\partial y^2})$
Option D:	$\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$

Q2	Solve any Four out of Six 5 marks each
A	Find Eigen values and Eigen vectors of matrix $\begin{bmatrix} 1 & -6 & -4 \\ 0 & 4 & 2 \\ 0 & -6 & -3 \end{bmatrix}$
B	Find the inverse Laplace transform of $\tan^{-1}\left(\frac{2}{s^2}\right)$.
C	Construct an analytic function whose imaginary part is $\tan^{-1}\left(\frac{y}{x}\right)$.
D	Solve $\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial u}{\partial t} = 0$ by Bender Schmidt Method, given u(0,t)=0 , u(4,t)=0, u(x,0)= x(4 - x).
E	Find Fourier series expansion of $f(x) = x^2$ in $(0, 2\pi)$.
F	Evaluate Laplace transform of $f(t) = \cos t \cos 2t \cos 3t$.

Q3.	Solve any Four out of Six 5 marks each
A	Find the half range sine series for $f(x) = \begin{cases} x, & 0 < x < \frac{\pi}{2} \\ \pi - x, & \frac{\pi}{2} < x < \pi \end{cases}$
B	Find Laplace transform of $f(t) = \sinh\frac{t}{2}\sin\frac{\sqrt{3}}{2}t$.
C	Show that $u = e^{2x}(x\cos 2y - y\sin 2y)$ is harmonic function.
D	Solve $\frac{\partial^2 u}{\partial x^2} - 16\frac{\partial u}{\partial t} = 0$ by Crank Nicolson simplified formula $0 < x < 1$, $t > 0$, given u(x,0)=0 , u(0,t)=0,u(1,t)= 200t Compute u for one step in t division taking h=1/4 .
E	Verify Cayley Hamilton theorem for matrix A= $\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$.
F	Find $L^{-1}\left(\frac{s^2}{(s^2+a^2)^2}\right)$ using convolution theorem.

Q4.	Solve any Four out of Six 5 marks each
A	Find half range cosine series for $f(x) = \sin x$ in $[0, \pi]$.
B	Find Laplace transform of $f(t) = \int_0^t e^{-3u}\, u \cos^2 2u\, du$.
C	Find the constants a, b, c & d if $f(z) = (x^2 + 2axy + by^2) + i(cx^2 + 2dxy + y^2)$ is an analytic function.
D	Evaluate $\int_0^\infty \frac{\cos at - \cos bt}{t} dt$.
E	Prove that $3\tan A = A\tan 3$, if matrix $A = \begin{bmatrix} -1 & 4 \\ 2 & 1 \end{bmatrix}$.
F	Find $L^{-1}\left(\frac{s^2}{(s^2+a^2)^2}\right)$ using convolution theorem.