

University of Mumbai

Examination 2020

Program: Civil Engineering
Curriculum Scheme: Rev2016

Examination: First/Second/Third/Final Year Semester I/II/III/IV/V/VI/VII/VIII

Course Code: and Course Name: Applied Mathematics III

Time: 1 hour

Max. Marks: 50

For the students:- All the Questions are compulsory and carry equal marks .

Q1.	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:	$\frac{-a}{s}(1 - e^{-bt})$
Q2.	Find the Laplace transform of $4t^2 + \sin 3t + e^{2t}$
Option A:	$\frac{9}{s^3} + \frac{3}{s^2 + 3^2} + \frac{1}{s - 2}$
Option B:	$\frac{8}{s^3} + \frac{8}{s^2 + 3^2} + \frac{1}{s - 2}$
Option C:	$\frac{8}{s^3} + \frac{3}{s^2 + 3^2} + \frac{4}{s - 2}$
Option D:	$\frac{8}{s^3} + \frac{3}{s^2 + 3^2} + \frac{1}{s - 2}$
Q3.	Construct an analytic function whose real part is $x^4 - 6x^2y^2 + y^4$
Option A:	$z^4 + c$
Option B:	$ez^4 + c$
Option C:	$e^4 + c$
Option D:	$x^4 + c$
Q4.	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:	$\frac{1 - e^{at}}{a}$
Q5.	Find $L^{-1}\left[\frac{1}{s(s^2+4)}\right]$

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Option A:	$\frac{1}{4}(1 - \cos 2t)$												
Option B:	$\frac{1}{45}(1 - \sin 2t)$												
Option C:	$\frac{1}{4}(1 - \cot 2t)$												
Option D:	$\frac{1}{4}(1 - \tan 2t)$												
Q6.	The equations of the two lines of regression are $5x - y = 22$ and $64x - 45y = 24$. Find x and y .												
Option A:	$x = 6, y = 8$												
Option B:	$x = 3, y = 8$												
Option C:	$x = 4, y = 8$												
Option D:	$x = 6, y = 5$												
Q7.	Given $N = 5, \sum d_i^2 = 8$. Find the rank correlation coefficient R .												
Option A:	$R = 0.6$												
Option B:	$R = 0.5$												
Option C:	$R = 0.4$												
Option D:	$R = 0.3$												
Q8.	Given $\sum d_x d_y = 186, \sum d_x = 11, \sum d_y = 7, N = 10, \sum d_x^2 = 215, \sum d_y^2 = 163$ Find the correlation coefficient r .												
Option A:	0.99												
Option B:	0.88												
Option C:	0.77												
Option D:	0.55												
Q9.	<p>Calculate the correlation coefficient for the following data</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>X</td> <td>3</td> <td>5</td> <td>4</td> <td>6</td> <td>2</td> </tr> <tr> <td>Y</td> <td>3</td> <td>4</td> <td>5</td> <td>2</td> <td>6</td> </tr> </tbody> </table>	X	3	5	4	6	2	Y	3	4	5	2	6
X	3	5	4	6	2								
Y	3	4	5	2	6								
Option A:	1												
Option B:	-.5												
Option C:	.7												
Option D:	.9												
Q10.	Construct an analytic function whose imaginary part is $\tan^{-1} \frac{y}{x}$												
Option A:	$\tan z + c$												
Option B:	$\sec z + c$												
Option C:	$e^x z + c$												
Option D:	$\log z + c$												
Q11.	Find the value of n for $x \cos x$ in $(-\pi, \pi)$												
Option A:	1/n												
Option B:	0												
Option C:	2/n												
Option D:	4												

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Q12.	In Fourier integral an is zero when function is
Option A:	Even
Option B:	Odd
Option C:	Real
Option D:	Neither even nor odd
Q13.	If $f(x)$ is odd function then Fourier integral $f(x)$ reduced to
Option A:	Cosine
Option B:	Sine
Option C:	Cosine and sine
Option D:	0
Q14.	What are periodic signals?
Option A:	The signals which change with time
Option B:	The signals which change with frequency
Option C:	The signal that repeats itself in time
Option D:	The signals that repeat itself over a fixed frequency
Q15.	Find the Laplace transform of $\sin 5t$
Option A:	$\frac{5}{s^2 + 5^2}$
Option B:	$\frac{s}{s^2 + 5^2}$
Option C:	$\frac{5}{s^2 - 5^2}$
Option D:	$\frac{s}{s^2 - 5^2}$
Q16.	Poles of $f(z) = \frac{1}{(z-1)(z+2)}$
Option A:	1,-2
Option B:	-1,-2
Option C:	-1,2
Option D:	1,2
Q17.	Poles of $f(z) = \frac{z}{(z+3)^2(z+2)}$
Option A:	-3 of order 2 and -2 of order 1
Option B:	-3 of order 2 and -2 of order 2
Option C:	3 of order 2 and -2 of order 1
Option D:	-3 of order 1 and -2 of order 2
Q18.	Find residue at $z=1$ for $f(z) = \frac{z}{(z+2)^2(z-1)}$
Option A:	1/9
Option B:	-1/9
Option C:	2/9
Option D:	-2/9

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Q19.	The partial differential equation $xy \frac{\partial z}{\partial x} = \frac{\partial^2 z}{\partial y^2}$
Option A:	Elliptic
Option B:	Hyperbolic
Option C:	Parabolic
Option D:	Not defined
Q20.	The partial differential equation $5 \frac{\partial^2 z}{\partial y^2} + 6 \frac{\partial^2 z}{\partial x^2} = xy$
Option A:	Elliptic
Option B:	Hyperbolic
Option C:	Parabolic
Option D:	Not defined

Q2 (20 Marks)	Solve any Four out of Six	5 marks each
A	Find the Laplace transform of $\frac{1}{t} e^{-t} \sin t$	
B	Find the inverse Laplace transform of $\frac{1}{\sqrt{2s+1}}$	
C	Show that the function, $f(z) = \sinh z$ is analytic and find $f'(z)$ in terms of z .	
D	Find the Fourier series for $f(x) = x$ in $(0, 2\pi)$.	
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	Find Eigen value and Eigen vector of matrix $\begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$	

Q3 (20 Marks)	Solve any Four out of Six	5 marks each
A	Find the Laplace transform of $\cos t \cos 2t \cos 3t$	
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 the Fourier series for $f(x) = e^{- x }$ in $(-\pi, \pi)$.	
E	Find Eigen value and Eigen vector of matrix $\begin{bmatrix} 2 & -1 & 1 \\ 1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$	
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.	