

University of Mumbai
Examination 2020 under cluster ___ (Lead College Shortname)

Program: Mechanical/CIVIL Engineering

Curriculum Scheme: Rev 2016

Examination: Second Year Semester III

Course Code: MEC/CEC 301 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.	$L(e^{2t} \cos \omega t) = \underline{\hspace{2cm}}$
Option A:	$\frac{s}{s^2 + \omega^2}$
Option B:	$\frac{(s - 2)}{(S - 2)^2 + \omega^2}$
Option C:	$\frac{(s + 2)}{(S + 2)^2 + \omega^2}$
Option D:	$\frac{2}{(S + \omega)^2 + 2^2}$
Q2.	What is the fixed point of $w = \frac{5 - 4z}{4z - 3}$
Option A:	$\frac{5}{4}, -1$
Option B:	$\frac{-5}{4}, 1$
Option C:	$-5, 4$
Option D:	$5, -4$
Q3.	Evaluate $\oint_C z^3 dz$ where C is a unit circle from $\theta = 0$ to $\theta = \pi$.
Option A:	0
Option B:	0.5
Option C:	2
Option D:	$\frac{1}{2}$
Q4.	Fourier coefficient a_0 of $f(x) = 2x - 1$ in $(0,3)$
Option A:	3
Option B:	$\frac{1}{2}$
Option C:	1
Option D:	2
Q5.	Find values of p, q if following is solution of

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	$\frac{\partial^2 u}{\partial x^2} - 200 \frac{\partial u}{\partial t} = 0, \text{ given } u(0,t) = 0, u(0.5,t) = 0, h = 0.1, k = 1.$ <p>using Bender-Schmidt method.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="text-align: center;">x \ t</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0.1</td> <td style="text-align: center;">0.2</td> <td style="text-align: center;">0.3</td> <td style="text-align: center;">0.4</td> <td style="text-align: center;">0.5</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">A</td> <td style="text-align: center;">0.09</td> <td style="text-align: center;">0.16</td> <td style="text-align: center;">0.21</td> <td style="text-align: center;">0.24</td> <td style="text-align: center;">c</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">B</td> <td style="text-align: center;">p</td> <td style="text-align: center;">0.15</td> <td style="text-align: center;">0.20</td> <td style="text-align: center;">q</td> <td style="text-align: center;">d</td> </tr> </table>	x \ t	0	0.1	0.2	0.3	0.4	0.5	1	A	0.09	0.16	0.21	0.24	c	2	B	p	0.15	0.20	q	d
x \ t	0	0.1	0.2	0.3	0.4	0.5																
1	A	0.09	0.16	0.21	0.24	c																
2	B	p	0.15	0.20	q	d																
Option A:	$p = 0.08, q = 0.15$																					
Option B:	$p = 0.15, q = 0.23$																					
Option C:	$p = 0.23, q = 0.15$																					
Option D:	$p = 0.08, q = 0.105$																					
Q6.	Find constants a, b if $f(z) = (3x^2y + 2x^2 + ay^3 - 2y^2) + i(bxy - x^3 + 3xy^2)$ is analytic.																					
Option A:	$a = 1, b = 4$																					
Option B:	$a = 4, b = 1$																					
Option C:	$a = -1, b = 4$																					
Option D:	$a = -1, b = -4$																					
Q7.	The function $f_3(x) = ax^2 - \frac{1}{2}$ is orthogonal to functions $f_1(x) = 1$ and $f_2(x) = x$ in the interval $(-1, 1)$. The value of a will be																					
Option A:	3																					
Option B:	$\frac{3}{2}$																					
Option C:	0																					
Option D:	None of these.																					
Q8.	Find the analytic function whose real part is $x^2 - y^2 + 3y - 2x + 3$.																					
Option A:	$f(z) = z^2 - 2z + 3zi$																					
Option B:	$f(z) = z^2 - 2z - 3zi$																					
Option C:	$f(z) = z^2 + 3z - 2zi$																					
Option D:	$f(z) = z^2 - 3z - 3zi + 4$																					
Q9.	$L(\int_0^t \int_0^t \int_0^t \sin u \, du^3) = \underline{\hspace{2cm}}$																					
Option A:	$\frac{1}{s^3(s^2 + 1)}$																					

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Option B:	$\frac{s^2}{(s^2 + 1)}$
Option C:	$\frac{s}{(S + 1)^2}$
Option D:	$\frac{1}{s^2(s^2 + 1)}$
Q10.	Find value of b_n in the Fourier expansion of function $f(x) = (2 - x^2)$ in the interval $(0, 2)$.
Option A:	$\frac{2}{n\pi} + \frac{2}{n^3\pi^3}$
Option B:	$\frac{2}{n\pi}$
Option C:	$\frac{4}{n\pi}$
Option D:	$\frac{4}{n^3\pi^3}$
Q11.	Find the value of $L^{-1}[\log(s^2 - 7s + 10)]$.
Option A:	$-\frac{1}{t}(e^{5t} - e^{-2t})$
Option B:	$\frac{1}{t}(e^{5t} + e^{2t})$
Option C:	$-\frac{1}{t}(e^{2t} - e^{5t})$
Option D:	$-\frac{1}{t}(e^{5t} + e^{2t})$
Q12.	Evaluate $\int_c \frac{2z-6}{(z-2)(z-5)} dz$ where c is the circle $ z = \frac{1}{2}$
Option A:	0
Option B:	$2\pi i$
Option C:	$-2\pi i$
Option D:	$-4\pi i$
Q13.	Evaluate $L^{-1}\left[\frac{1}{(s-2)^4}\right]$.
Option A:	$e^{2t} \frac{t^3}{3!}$
Option B:	$e^{2t} \frac{t^5}{5}$
Option C:	$e^{-2t} \frac{t^4}{4!}$

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Option D:	$e^{-2t} \frac{t^5}{5!}$																		
Q14.	Find poles of function $\frac{1}{z \cos z}$.																		
Option A:	0																		
Option B:	$n\pi$ for $n = 0, \pm 1, \pm 2, \dots$																		
Option C:	$\frac{n\pi}{2}$ for $n = 0, \pm 1, \pm 2, \dots$																		
Option D:	$0, \frac{(2n+1)\pi}{2}$ for $n = 0, \pm 1, \pm 2, \dots$																		
Q15.	<p>Find values of unknown 'j' if following is solution of</p> $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0, \text{ given } u(x, 0) = 0, u(0, t) = 0, h = \frac{1}{4}.$ <p>using Crank- Nicholson simplified formula.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">x \ t</td> <td>0</td> <td>0.25</td> <td>0.5</td> <td>0.75</td> <td>1</td> </tr> <tr> <td>a</td> <td>B</td> <td>c</td> <td>d</td> <td>e</td> <td>f</td> </tr> <tr> <td>g</td> <td>H</td> <td>i</td> <td>j</td> <td>k</td> <td>1/16</td> </tr> </table>	x \ t	0	0.25	0.5	0.75	1	a	B	c	d	e	f	g	H	i	j	k	1/16
x \ t	0	0.25	0.5	0.75	1														
a	B	c	d	e	f														
g	H	i	j	k	1/16														
Option A:	0.0011																		
Option B:	0.00446																		
Option C:	0.0132																		
Option D:	0.0167																		
Q16.	If $f(z) = r^3 \cos k\theta + ir^k \sin k\theta$ is analytic then $k = \underline{\hspace{2cm}}$.																		
Option A:	-4																		
Option B:	4																		
Option C:	-3																		
Option D:	3																		
Q17.	Evaluate $L^{-1} \left[\frac{1}{s(s-3)} \right]$.																		
Option A:	$\frac{1}{3} + \frac{1}{3} e^{3t}$																		
Option B:	$\frac{-1}{3} e^{3t} + \frac{1}{3} e^{3t}$																		
Option C:	$\frac{1}{3} (e^{3t} - 1)$																		
Option D:	$\frac{1}{3} (1 - e^{3t})$																		
Q18.	$f(x) = x $ in $(-\pi, \pi)$ then Fourier Coefficient $a_n = \underline{\hspace{2cm}}$																		

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Option A:	$\frac{[(-1)^n - 1]}{n^2\pi}$																		
Option B:	$\frac{2[(-1)^n - 1]}{n^2\pi}$																		
Option C:	0																		
Option D:	$\frac{2[(-1)^n + 1]}{n^2\pi}$																		
Q19.	<p>Following are ranks of students in Physics and Chemistry. Find Spearman Rank correlation coefficient.</p> <table border="1" style="margin-left: 20px;"> <tbody> <tr> <td>Rank in Physics</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> </tr> <tr> <td>Rank in Chemistry</td> <td>2</td> <td>4</td> <td>1</td> <td>5</td> <td>3</td> <td>8</td> <td>7</td> <td>6</td> </tr> </tbody> </table>	Rank in Physics	1	2	3	4	5	6	7	8	Rank in Chemistry	2	4	1	5	3	8	7	6
Rank in Physics	1	2	3	4	5	6	7	8											
Rank in Chemistry	2	4	1	5	3	8	7	6											
Option A:	0.89																		
Option B:	0.74																		
Option C:	0.29																		
Option D:	0.98																		
Q20.	In half range cosine series of $f(x) = x$ in $(0,2)$ value of b_n is																		
Option A:	1																		
Option B:	$\frac{4[(-1)^n - 1]}{n^2\pi^2}$																		
Option C:	$\frac{4[(-1)^n + 1]}{n^2\pi^2}$																		
Option D:	0																		
Q21.	Using applications of residue theorem, $\int_0^{2\pi} \frac{d\theta}{2+5\sin\theta} = \underline{\hspace{2cm}}$																		
Option A:	$\int_c \frac{2dz}{2z^2 + 4iz + 5}$ where c is $ z =1$																		
Option B:	$\int_c \frac{2dz}{5z^2 + 4iz - 5}$ where c is $ z =1$																		
Option C:	$\int_c \frac{2dz}{3z^2 + 10iz - 3}$ where c is $ z =1$																		
Option D:	$\int_c \frac{dz}{2z^2 + 10iz - 2}$ where c is $ z =1$																		
Q22.	$\int_0^\infty e^{-t} \operatorname{erf} 3\sqrt{t} dt = \underline{\hspace{2cm}}$																		
Option A:	$\frac{3}{\sqrt{10}}$																		
Option B:	$\frac{1}{\sqrt{5}}$																		

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Option C:	$\frac{9}{\sqrt{10}}$																		
Option D:	$\frac{2}{\sqrt{5}}$																		
Q23.	Evaluate $\int_c \frac{zdz}{(z-1)(z-2)}$ where c is the circle $ z =3$																		
Option A:	$2\pi i$																		
Option B:	$6\pi i$																		
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Q24.	<p>Find values of unknown 'e' if following is solution of</p> $\frac{\partial^2 u}{\partial x^2} - \frac{1}{4} \frac{\partial u}{\partial t} = 0, \text{ given } u(0,t) = 0, u(4,t) = 0, h = 1.$ <p>using Bender-Schmidt method.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <tr> <td style="border: none;">x \ t</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>a</td> <td>c</td> <td>3.5</td> <td>6</td> <td>7.5</td> <td>g</td> </tr> <tr> <td>b</td> <td>d</td> <td>e</td> <td>5.5</td> <td>f</td> <td>h</td> </tr> </table>	x \ t	0	1	2	3	4	a	c	3.5	6	7.5	g	b	d	e	5.5	f	h
x \ t	0	1	2	3	4														
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Option A:	3.5																		
Option B:	2																		
Option C:	3																		
Option D:	3.75																		
Q25.	Find the image of interior of circle $ z =1$ under the transformation $W = \frac{1}{z}$																		
Option A:	interior of circle $ w =1$																		
Option B:	Exterior of circle $ w =1$																		
Option C:	$ w =1$																		
Option D:	real axis in W- plane																		