University of Mumbai

Examination 2021 under cluster __ (Lead College: _____)

Examinations Commencing from 1st June 2021 to 10th June 2021

Program: **BE Electronics and Telecommunication Engineering**

Curriculum Scheme: Rev 2019 'C' Scheme

Examination: SE Semester IV

Course Code: ECC401 and Course Name: Engineering Mathematics IV

Time: 2 hour

Max. Marks: 80

Note : Q1 carrying 40 marks. Q2 and Q3 are carrying 20 equal marks.

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks.2 marks each
1.	If x is a discrete random variable with the following probability distribution
	x 1 2 3
	P(x) a 2a a
	Find $P(X \le 2)$.
Option A:	1
	4
Option B:	1
	2
Option C:	<u>3</u>
	$ \begin{array}{c} 4 \\ \hline 1 \\ \hline 2 \\ \hline 3 \\ \hline 4 \\ \hline 1 \\ \hline \end{array} $
Option D:	1
2.	$(3, c_2, \ldots, 2)$
۷.	Find E(X) if X has the p.d.f $f(x) = \begin{cases} \frac{3}{4}(2x - x^2) & 0 \le x \le 2\\ 0 & 0 \end{cases}$, otherwise
	(0 , otherwise
Option A:	3
	2
Option B:	1
Option C:	2
Option D:	1
	2
2	
3.	If X and Y are independent random variables with means 2,3 and variance 1,2
	respectively, find the mean and variance of the random variable $Z = 2X - 5Y$
Option A:	-11,54
Option B:	19, 54
Option C:	19, -8
Option D:	-11, -8
4.	Suppose the number of accidents occurring weekly on a particular stretch of a
+.	highway follow a Poisson distribution with mean 3 . Calculate the probability that
	there is at least one accident this week.
Option A:	0.6 347
Option B:	0.9502
· _ ·	1

Option C:	0.7275							
Option D:	0.8002							
option D.								
5.	The following results were obtained from records of age (x) and systolic blood							
5.	pressure (y) of a group of 10 men:							
	pressure (y) or a group		V					
	maan	53	у 142					
	mean							
	variance	130	165					
	Correlation coefficient = 0.8							
	Estimate the blood pres	sure of a ma	in whose age	18 45?				
Option A:	134.78							
Option B:	130.56							
Option C:	129.56							
Option D:	137.56							
<u>6.</u>	A coefficient of correla							
Option A:	The relationship between the two variables is weak							
Option B:	The relationship between the two variables is strong and positive.							
Option C:	The relationship betwee							
Option D:	The correlation coeffici	ent cannot h	have this valu	le.				
		1 1	1 .1 1'					
7.	1	-	•	e of regression of y on x is 0.6				
	and $\sigma_x = \frac{1}{2}\sigma_y$ Find the	ne correlation	on coefficient	t between x and y.				
Option A:	- 2.5							
Option B:	0.25							
Option C:	- 0.3							
Option D:	0.3							
8.	Evaluate $\int_{C} \frac{7z-1}{(z-3)(z+5)} dz$	<i>dz</i> , where c	is the circle	z =1.				
Ontion A.	⁵ C (z-3)(z+5)	,						
Option A:	2πi							
Option B:	0							
	0							
Option C:	<u>6</u> πi							
Option D:	πί							
- r								
9.	Find the residue of f(.	z^2	ot 7 -	2				
	Find the residue of $f(z)$	$z_{j} = \frac{1}{(z+2)(z-1)}$	$(-1)^2$ at $Z = -$	2				
Option A:	1/9							
Option B:	5/9							
Option C:	1/3							
Option D:	4/9							
10.	Identify the type of sing	gularity of th	the function f	$f(z) = \frac{\sinh z}{z}$				
		•	,	Ζ'				
Option A:	z = 0 is a pole of order	7 for the giv	en function					
Option B:	z = 0 is a pole of order 6 for the given function							
Option D:	z = 0 is a pole of order $z = 0$ is an essential single							
option C.		<u>-</u>						

11.Evaluate $\int_C \frac{e^x}{x-1} dx$ where C where c is the circle $ x = 2$.Option A: $2\pi i$ Option B: $2\pi ie^2$ Option C: $2\pi ie^2$ Option D: πie^2 12.Find the value of the integral $\int_0^{1+i} (x^2 - iy) dx$ along the path $y = x$ Option A: $5-i$ 6 6 Option B: $5+i$ 6 6 Option C: $1+5i$ 6 6 Option A: $(1,-2,1)$ Option A: $(1,-2,1)$ Option B: $(1,-2,1)$ Option D: $(2,-2,1)$ Option D: $(2,-2,1)$ Option D: $(2,-2,-1)$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option B: $5, \sqrt{3}, \sqrt{10}$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option B: $5, \sqrt{30}, 3$ Option D: $6, \sqrt{30}, 3$ Option C: $5, \sqrt{30}, 3$ Option C: $5, \sqrt{30}, 3$ Option C: $5, \sqrt{2}, \sqrt{6}$ Option C: $5, \sqrt{30}, 3$ Option C: $5, \sqrt{2}, \sqrt{6}$ Option C: $5, \sqrt{30}, 3$ Option C: $5, \sqrt{30}, 3$ Option C: $4, xer$ not the subspaces of R^3 Option C: $4, xer$ as the subspaces of R^3 Option C: $1, 2x^2, -7x_3, -4x_1x_2 + 6x_2x_3 + 8x_3x_1$ Option D: $1, -2, 4$ $-2, 2, 3$ I $1, -4, 8$ $-4, 2, 6$ $8, 6, -7$ Option B: $1, -4, 8$ $-4, 2, 6$ $-4, 2, 6$ $-4, 2, 6$ $-4, 2, 6$	Option D:	z = 0 is a pole of order 3 for the given function						
Option A: $2 \pi i$ Option B: $2 \pi i e^2$ Option D: $\pi i e^2$ 12.Find the value of the integral $\int_0^{1+i} (x^2 - iy) dz$ along the path $y = x$ Option A: $5 - i$ 6 6 Option R: $5 + i$ 6 6 Option D: $1 - 5i$ 6 6 Option D: $1 - 5i$ 6 6 Option D: $1 - 5i$ 6 6 Option A: $(1, -2, 1)$ Option A: $(1, -2, 1)$ Option D: $(2, -2, 1)$ Option D: $(2, -2, 1)$ Option B: $5 - \sqrt{3}, \sqrt{10}$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option D: $6, \sqrt{30}, 3$ Option A: $W_1 and W_2 are the subspaces of R^3Option D:W_1 is not a subapace of R^3 but W_2 is a subspace of R^3Option D:W_1 is not a subapace of R^3 but W_2 is a subspace of R^3Option D:W_1 is not a subapace of R^3 but W_2 is a subspace of R^3Option A:1 - 2 + 4-2 + 2 = 34 + 3 - 7Option B:1 - 4 = 8<$								
Option B: $2 \pi i e^2$ Option C: $2 \pi i e$ Option D: $\pi i e^2$ 12.Find the value of the integral $\int_{0}^{1+i} (x^2 - iy) dz$ along the path $y = x$ Option A: $\frac{5-i}{6}$ Option B: $\frac{5+i}{6}$ Option C: $1 + 5i$ $\frac{6}{6}$ Option D: $1 - 5i$ $\frac{6}{6}$ Option A: $(1, -2, 1)$ Option A: $(1, -2, 1)$ Option C: $(1, -1, 1)$ Option D: $(2, 2, -1)$ Option D: $(2, 2, -1)$ Option B: $5 + \sqrt{2}$, $\sqrt{6}$ Option B: $5 - \sqrt{30}$, $\sqrt{10}$ Option B: $5 - \sqrt{30}$, $\sqrt{10}$ Option B: $5 - \sqrt{30}$, 3 Option D: $6 + \sqrt{30}$, 3 Option B: $5 + \sqrt{2}$, $\sqrt{6}$ Option B: $5 + \sqrt{2}$, $\sqrt{6}$ Option B: $6 + \sqrt{30}$, 3 Option D: $6 + \sqrt{30}$, $3 = 0$ Option A: $W_1 and W_2 are the subspaces of R^3Option D:W_1 is not a subapace of R^3 but W_2 is a subspace of R^3Option D:W_1 is not a subapace of R^3 but W_2 is a subspace of R^3Option D:W_1 is not a subapace of R^3 but W_2 is a subspace of R^3Option D:W_1 is not a subapace of R^3 but W_2 is a subspace of R^3Option D:W_1 is not a subapace of R^3 but W_2 is a subspace of R^3$	11.	Evaluate $\int_C \frac{e^z}{z-1} dz$ where C where c is the circle $ z = 2$.						
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12.Find the value of the integral $\int_{0}^{1+i} (x^2 - iy) dz$ along the path $y = x$ Option A: $5-i$ 6 Option B: $5+i$ 6 Option C: $1+5i$ 6 Option D: $1-5i$ 6 0ption A: $(1,-2, 1)$ Option B: $(2, -2, 1)$ Option D: $(1, -2, 1)$ Option D: $(2, -2, 1)$ Option D: $(2, -2, 1)$ Option A: $(1, -2, 1)$ Option B: $(2, -2, 1)$ Option B: $(2, -2, -1)$ Option D: $(2, 2, -1)$ 14.If $u = (3, 1, 4, -2) v = (2, 2, 0, 1)$ then find $\langle u, v \rangle$ and $ u . v $ Option A: $-6, \sqrt{30}, \sqrt{10}$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option D: $(6, \sqrt{30}, 3)$ 15Determine which of the following are subspaces of R^3 $W_1 = ((a, 0, b), a, b \in R)$ $W_1 and W_2$ are the subspaces of R^3 Option B: W_1 and W_2 are not the subspaces of R^3 Option C: W_1 is a subspace of R^3 but W_2 is a subspace of R^3 Option D: $6, \sqrt{30}, 2 = 7$ 16.Write down the matrix of the quadratic form $x_1^2 + 2x_2^2 - 7x_3^2 - 4x_1x_2 + 6x_2x_3 + 8x_3x_1$ Option A: $1 - 4 = 8$ $-4 = 2 = 6$	Option C:	2 πie						
Option A: $\frac{5-i}{6}$ Option B: $5+i$ $\frac{5}{6}$ $\frac{5}{6}$ Option C: $1+5i$ $\frac{6}{6}$ $\frac{1-5i}{6}$ 0ption D: $1-5i$ $\frac{6}{6}$ $\frac{1}{6}$ 0ption A: $(1, -2, 1)$ Option B: $(2, -2, 1)$ Option D: $(1, -2, 1)$ Option D: $(2, 2, -1)$ Option A: $(1, -1, 1)$ Option A: $-6, \sqrt{30}, \sqrt{10}$ Option A: $-6, \sqrt{30}, \sqrt{10}$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option C: $5, \sqrt{30}, 3$ Option C: $5, \sqrt{30}, 3$ Option D: $6, \sqrt{30}, 3$ Option D: $6, \sqrt{30}, 3$ Option D: $6, \sqrt{30}, 3$ Option A: $w_1 and w_2$ are the subspaces of R^3 $w_2=\{(a, b, 1), a, b \in R\}$ $w_2=\{(a, b, 1), a, b \in R\}$ $w_2=\{(a, b, 1), a, b \in R\}$ w_2 is not a subspace of R^3 Option A: w_1 and w_2 are not the subspaces of R^3 Option B: w_1 and w_2 are not the subspace of R^3 Option D: w_1 is not a subapace of R	Option D:	πie ²						
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$\overline{6}$ Option D: $1-5i$ $\overline{6}$ 13.Find the vector orthogonal to $(2,1,-2)$ and $(1,2,2)$ Option A: $(1,-2,1)$ Option B: $(2, -2, 1)$ Option D: $(2, 2, -1)$ Option D: $(2, 2, -1)$ Option A: $-6, \sqrt{30}, \sqrt{10}$ Option A: $-6, \sqrt{30}, \sqrt{10}$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option D: $6, \sqrt{30}, 3$ Option D: $6, \sqrt{30}, 3$ Option D: $6, \sqrt{30}, 3$ Option A: $-6, \sqrt{30}, 3$ Option A: $-4, \sqrt{30}, 3$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option D: $6, \sqrt{30}, 3$ Option A: $W_{1and W_{2} are the subspaces of R^{3}W_{2}=\{(a, b, 1), a, b \in R\}W_{2}=\{(a, b, 1), a, b \in R\}Option A:W_{1and W_{2} are not the subspaces of R^{3}Option D:W_{1is not a subapace of R^{3} but W_{2} is not a subspace of R^{3}Option D:W_{1is not a subapace of R^{3} but W_{2} is a subspace of R^{3}Option A:1 -2 - 4-2 - 2 - 3-4 -2 - 6Option B:1 -4 -4 -8-4 -2 - 6$	Option B:	$\frac{b}{5+i}$						
$\overline{6}$ Option D: $1-5i$ $\overline{6}$ 13.Find the vector orthogonal to $(2,1,-2)$ and $(1,2,2)$ Option A: $(1,-2,1)$ Option B: $(2, -2, 1)$ Option D: $(2, 2, -1)$ Option D: $(2, 2, -1)$ Option A: $-6, \sqrt{30}, \sqrt{10}$ Option A: $-6, \sqrt{30}, \sqrt{10}$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option D: $6, \sqrt{30}, 3$ Option D: $6, \sqrt{30}, 3$ Option D: $6, \sqrt{30}, 3$ Option A: $-6, \sqrt{30}, 3$ Option A: $-4, \sqrt{30}, 3$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option D: $6, \sqrt{30}, 3$ Option A: $W_{1and W_{2} are the subspaces of R^{3}W_{2}=\{(a, b, 1), a, b \in R\}W_{2}=\{(a, b, 1), a, b \in R\}Option A:W_{1and W_{2} are not the subspaces of R^{3}Option D:W_{1is not a subapace of R^{3} but W_{2} is not a subspace of R^{3}Option D:W_{1is not a subapace of R^{3} but W_{2} is a subspace of R^{3}Option A:1 -2 - 4-2 - 2 - 3-4 -2 - 6Option B:1 -4 -4 -8-4 -2 - 6$	Option C [.]	<u>6</u> 1 + 5 <i>i</i>						
iii3.Find the vector orthogonal to $(2,1,-2)$ and $(1,2,2)$ Option A: $(1,-2,1)$ Option B: $(2,-2,1)$ Option D: $(2,2,-1)$ I4.If $u = (3, 1, 4, -2) v = (2, 2, 0, 1)$ then find $\langle u, v \rangle$ and $ u . v $ Option A: $-6, \sqrt{30}, \sqrt{10}$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option D: $6, \sqrt{30}, 3$ Option A: $-g, \sqrt{30}, 3$ I5Determine which of the following are subspaces of R^3 $W_1=\{(a, 0, b), a, b \in R\}$ $W_2=\{(a, b, 1), a, b \in R\}$ Option A: $W_1and W_2$ are the subspaces of R^3 Option B: W_1 and W_2 are not the subspaces of R^3 Option D: $0, is not a subapace of R^3$ but W_2 is not a subspace of R^3 Option D: W_1 is not a subapace of R^3 but W_2 is a subspace of R^3 Option A: $1 -2 - 4$ $-2 - 2 - 3$ $4 -3 - 7$ Option B: $1 -4 - 8$ $-4 - 2 - 6$								
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Option A: $(1,-2,1)$ Option B: $(2,-2,1)$ Option C: $(1,-1,1)$ Option D: $(2,2,-1)$ 14. If $u = (3, 1, 4, -2)$ $v = (2, 2, 0, 1)$ then find $\langle u, v \rangle$ and $ u , v $ Option A: $-6, \sqrt{30}, \sqrt{10}$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option D: $6, \sqrt{30}, 3$ Option D: $M_1 a, b \in R$ $W_2=\{(a, b, 1), a, b \in R\}$ $W_2=\{(a, b, 1), a, b \in R\}$ Option A: $W_1 and W_2 are not the subspaces of R^3 Option B: W_1 and W_2 are not the subspaces of R^3 Option D: W_1 is not a subapace of R^3 but W_2 is not a subspace of R^3 Option D: W_1 is not a subapace of R^3 but W_2 is a subspace of R^3 I -2 2 3 4 3 -7 Option B: \begin{bmatrix} 1 & -2 & 4 \\ -2 & 2 & 3 \\ 4 & 3 & -7 \end{bmatrix} Opti$		0						
Option B: $(2, -2, 1)$ Option C: $(1, -1, 1)$ Option D: $(2, 2, -1)$ If $u = (3, 1, 4, -2)$ $v = (2, 2, 0, 1)$ then find $\langle u, v \rangle$ and $ u , v $ Option A: $-6, \sqrt{30}$, $\sqrt{10}$ Option B: $5, \sqrt{2}, \sqrt{6}$ Option D: $6, \sqrt{30}, 3$ Option A: $W_1 = \{(a, 0, b), a, b \in R\}$ $W_2 = \{(a, b, 1), a, b \in R\}$ $W_2 = \{(a, b, 1), a, b \in R\}$ Option A: W_1 and W_2 are not the subspaces of R^3 Option B: W_1 and W_2 are not the subspace of R^3 Option D: W_1 is not a subapace of R^3 but W_2 is a subspace of R^3 Option D: W_1 is not a subapace of R^3 but W_2 is a subspace of R^3 If $-2, 2, 3$ $4, 3, -7]$ Option B: $1, -4, 4$ If $-4, 2, 6$ <td></td> <td>Find the vector orthogonal to $(2,1,-2)$ and $(1,2,2)$</td>		Find the vector orthogonal to $(2,1,-2)$ and $(1,2,2)$						
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Option A:	16.	-						
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Option A.							
$-4 \ 2 \ 6$		4 3 -7						
	Option B:							

Option C:	
Option C.	$\begin{bmatrix} 1 & 2 & 4 \\ 2 & 2 & 3 \\ 4 & 3 & -7 \end{bmatrix}$ $\begin{bmatrix} 1 & 4 & 8 \\ 4 & 2 & 6 \\ 8 & 6 & 7 \end{bmatrix}$
Option D:	
	4 2 6
17	
17.	Find the rank, signature, index of the transformed quadratic form $\frac{39}{2}$
	$3y_1^2 + \frac{2}{3}y_2^2 - \frac{39}{2}y_3^2.$
Option A:	rank = 3, signature =2, index =1
Option B:	rank = 3, signature =1, index =2.
Option C:	rank = 2, signature =3, index =1.
Option D:	rank = 2, signatur e=1, index =3.
	<u></u>
18.	A necessary condition for $I = \int_{x_1}^{x_2} f(x, y, y^{ }, y^{ }) dx$ to be an extremal is that
Option A:	$\left \frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y}\right) + \frac{d^2}{dx^2}\left(\frac{\partial f}{\partial y}\right)\right = 0$
Option B:	$\left \frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y}\right)\right = 0$
Option C:	$\left \frac{\partial f}{\partial y} + \frac{d}{dx}\left(\frac{\partial f}{\partial y^{\parallel}}\right) = 0\right $
Option D:	$\frac{\partial f}{\partial y} + \frac{d}{dx} \left(\frac{\partial f}{\partial y^{ }} \right) + \frac{d^2}{dx^2} \left(\frac{\partial f}{\partial y^{ }} \right) = 0$
19.	The functional I= $\int_{a}^{b} (y)^{2} + 12xy dx$ has the following extremal with c_{1} and c_{2} as
	arbitrary constants.
Option A:	
Option B:	$ \begin{array}{c} c_1 x^3 + c_2 x \\ x^2 + c_1 x + c_2 \end{array} \\ \end{array} $
Option C:	
Option D:	$c_1 x + c_2$ $x^3 + c_1 x + c_2$
20.	The extremal of the functional $I = \int_a^b (16y^2 - y^{ ^2} + x^2) dx$ is
Option A:	$y = c_1 cos 2x + c_2 sin 2x$
Option B:	$y = c_1 e^{2x} + c_2 e^{-2x}$
Option C:	$y = c_1 e^{2x} + c_2 e^{-2x} + c_3 cos 2x + c_4 sin 2x$
Option D:	$y = c_1 e^x + c_2 e^{-x} + c_3 cosx + c_4 sinx$
I	

Q2. (20 Marks)	Solve any Four out of Six.						5 r	narks each				
	Fit a Poisson distribution for the following distribution.											
А		х		0	1	2	3	4	Total			
		f		43	40	25	10	2	120			
	Obtain	n the ra	nk cor	relation	on coef	ficient fo	or the f	follow	ing data			_
В	Х	68	64	75	50	64	80	75	40	55	64	
	Y	62	58	68	45	81	60	68	48	50	70	
С	Obtain two distinct Laurent's series of $f(z) = \frac{2z-3}{z^2-4z+3}$ about $z = 4$ indicating the region of convergence											
D	Construct an orthonormal basis of R^3 using Gram-Schmidt process to S = {(1,0,0), (3, 7, -2), (0,4,1)}											
E	Reduce the symmetric matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ to the diagonal form using congruent transformation and interpret the result in terms of quadratic forms											
F	Find the curve on which the functional $\int_a^b \sqrt{1+y^2} dx$ is extremum.											

Q3.	Solve any Four out of Six.5 marks each						
(20 Marks)							
А	In a sample of 1000 cases, the mean of a certain test is 14 and standard deviation is 2.5 Assuming the distribution to be normal ,find (i)how many students score between 12 and 15 ? (ii) how many score above 18? (iii) how many score below 8?						
В	In a partially destroyed laboratory, record of an analysis of correlation data, the following results only are legible: $\sigma_x = 3$. Regression equations: $8X-10Y = -66$, $40X-18Y=214$. What are: (i) the mean values X and Y, (ii) the correlation coefficient between X and Y, (iii) the standard deviation of Y						
С	Evaluate $\oint_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-2)(z-3)} dz$ where C is the circle $ z = 4$						
D	Let V be a set of positive real numbers with addition and scalar multiplication defined as $x + y = xy$ and $cx = x^c$. Show that V is a vector space under this addition and scalar multiplication.						
Е	Reduce the following quadratic form into canonical form. Q: $x_1^2 + 2x_2^2 + 3x_3^2 - 2x_1x_3 + 2x_2x_3 + 2x_2x_1$						
F	Using Rayleigh -Ritz method, solve the boundary value problem $I=\int_0^1 (y ^2 - y^2 - 2xy) dx \text{ with } y(0)=0 \text{ and } y(1)=0.$						