



**RAMAIAH**  
College of Arts, Science &  
Commerce

ಎಮ್ ಎಸ್ ರಾಮಯ್ಯ ಕಲಾ, ವಿಜ್ಞಾನ ಮತ್ತು ವಾಣಿಜ್ಯ ಕಾಲೇಜು

**M S Ramaiah College of Arts, Science and Commerce**

Re-accredited 'A' by NAAC, Permanently Affiliated to Bengaluru City University,

Approved by Government of Karnataka, Approved by AICTE, New Delhi,

Recognized by UGC under 2f & 12B of UGC act 1956



(National Institutional Ranking Framework, Ministry of Education, Govt of India)

Ranked 62<sup>nd</sup> in NIRF India Ranking by MHRD, New Delhi

DBT Star College Scheme

REF: MSRCASC/MATH/2021-2022/001

Date:07-10-2021

## CIRCULAR

### DEPARTMENT OF MATHEMATICS

This is to inform that, Department of Mathematics is organizing Value Added Course on “**Linear Algebra and singular value decomposition**” from 12<sup>th</sup> October 2021 to 4<sup>th</sup> January 2022 for the students of 2<sup>nd</sup> year B.Sc(EMCs) between 3:00 PM and 4:00 PM. Interested students can enroll their names with event coordinator Mrs.Thulasi.R.Mudakavi .

HOD

HEAD OF THE DEPARTMENT  
MATHEMATICS  
RAMAIAH COLLEGE  
OF ARTS, SCIENCE & COMMERCE  
BANGALORE-560054

PRINCIPAL

Principal,

M.S. Ramaiah College of Arts, Science & Commerce

MSRIT Post, MSR Nagar

Bangalore - 560 054

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Bangalore 560 054

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+91 80 2360 6905  
F +91 80 2360 6213

E principal.msrmasc@gmail.com  
W www.msrmasc.edu.in



## ABOUT THE COLLEGE

Ramaiah College of Arts, Science and Commerce was established in 1994 by our founder Late Dr.M.S Ramaiah offering both under graduate and postgraduate degrees under Bangalore City University in Arts, Science, Commerce and Management streams. The college is approved by AICTE, New Delhi, recognized by the Government of Karnataka. The college is re accredited 'A' grade by NAAC.

## ABOUT THE DEPARTMENT

The Department of Mathematics was established since the inception of the college in 1994. The department is strong with all the members of the faculty having more than 10 years of experience. We go by the vision and mission of the college. Department has approximately 220 students. Apart from following the curriculum, the department concentrates in training the students to face all competitive exams boldly and confidently. We encourage the students who attend workshops, seminars in other colleges.

## COURSE OUTLINE

- solving systems of linear equations
- basic terminology of linear algebra in euclidean spaces
- including linear independence, spanning, basis, rank, nullity, subspace
- abstract notions of vector space
- inner product space
- use of eigen values and eigen vectors

## OBJECTIVE

The objective of this value added course is to provide computational proficiency involving procedures in linear algebra, to understand and construct simple proofs and to solve problems that apply linear algebra to chemistry, economics and engineering.

## OUTCOME

Through this value added course students will understand and learn the concepts of vector space and subspace. They will also understand and learn the concepts of eigenvalues and eigenvectors and solve eigenvalue problems.

## PATRONS

Dr.M.R.Jayaram Chairman  
GEF  
Sri.M.R.Janakiram Director  
GEF  
Sri.M.R.Kodandaram  
Director GEF  
Sri. B.S Ramaprasad Chief  
Executive GEF(E & GS)  
Sri.G.Ramachandra Chief of  
Finance GEF(E & GS)

## ORGANIZING COMMITTEE MEMBERS

Mr.Ravindranath.K  
Mrs.Haritha.A  
Mrs.Thulasi R Mudakavi

## RESOURCE PERSON

K.Ravindranath  
Associate Professor  
Dept of Mathematics  
MSRCASC  
Event co-ordinator  
Mrs.Thulasi.R.Mudakavi

**FREE  
REGISTRATION**



Value Added Course  
on

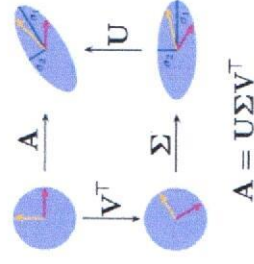
# Linear Algebra and Singular Value Decomposition

Organized by  
DEPARTMENT OF  
MATHEMATICS

## Program Schedule

Date : 12-10-2021 to  
04-01-2022

Time : 3:00pm to 4:00pm  
Venue: Room No. 309







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## DEPARTMENT OF MATHEMATICS

### REPORT ON VALUE ADDED COURSE CONDUCTED FROM 12<sup>TH</sup> OCTOBER 2021 TO 4<sup>TH</sup> JANUARY 2022

**Title:** Linear Algebra and singular value decomposition

**Date:** 12/10/2021 to 04/01/2022

**Venue:** Room Number: 309

**Participants:** 2<sup>nd</sup> year B.Sc(EMCs) students.

**Resource Person:** Mr. K.Ravindranath

**Number of Students:** 22

**Event Co-Ordinator:** Mrs. Thulasi.R.Mudakavi

**Objective:** The value added course is designed to provide Basic knowledge of Linear Algebra. The objective of this value added course is to provide computational proficiency involving procedures in linear algebra, to understand and construct simple proofs and to solve problems that apply linear algebra to chemistry, economics and engineering.

Department of Mathematics organized value added course on Applications of Linear Algebra from 12<sup>th</sup> October 2021 to 4<sup>th</sup> January 2022 for the students of 2<sup>nd</sup> year B.Sc(EMCs). The value added course was inaugurated by Dr.A.Nagarathna, Principal under the patronage of Sri.M.R. Janakiram (Honorable Director, Gokula Education Foundation), Sri.M.R.Kodandaram (Honorable Director, Gokula Education Foundation) and Sri.Ramprasad (Chief Executive, Gen Science, Gokula Education Foundation). The resource person to the course was Mr. K.Ravindranath. This programme was conducted for 30 hrs.

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The registration process started on 7th October 2021. The program started at 2:45pm on 12th October 2021 followed by the inauguration and then the sessions began with the brief introduction of the resource person and few words delivered by principal madam.

The session started with basics such as vectors, binary operations, distributive law, associative law, Groups etc. He explained about solving systems of linear equations, using technology to facilitate row reduction, definition of vector space, basics problems, miscellaneous problems, properties, theorems. Definition of sub space, basics problems, miscellaneous problems, properties, theorems were explained. Linearly dependent, independent vectors, spanning, basis dimensions, rank and nullity theorem,

The following are the topics covered in the sessions:

1. The basic arithmetic operations on vectors and matrices, including inversion and determinants, using technology where appropriate.
2. Solving systems of linear equations, using technology to facilitate row reduction;
3. The basic terminology of linear algebra in euclidean spaces, including linear independence, spanning, basis, rank, nullity, subspace, and linear transformation;
4. The abstract notions of vector space and inner product space;
5. Finding eigenvalues and eigenvectors of a matrix or a linear transformation, and using them to diagonalize a matrix;
6. Singular Value Decomposition (SVD) of a matrix i.e a factorization of that matrix into three matrices.

The main conclusion of this course was connected with the enhancing of students understanding of mathematics and their interest in mathematical subjects in general.

**Outcome:**

[1] Understand and learn the concepts of vector space and subspace.

[ 2 ] Understand and learn the concepts of linear independence, span, and basis.

[ 3 ] Understand and learn the concepts of eigenvalues and eigenvectors and solve eigenvalue problems.

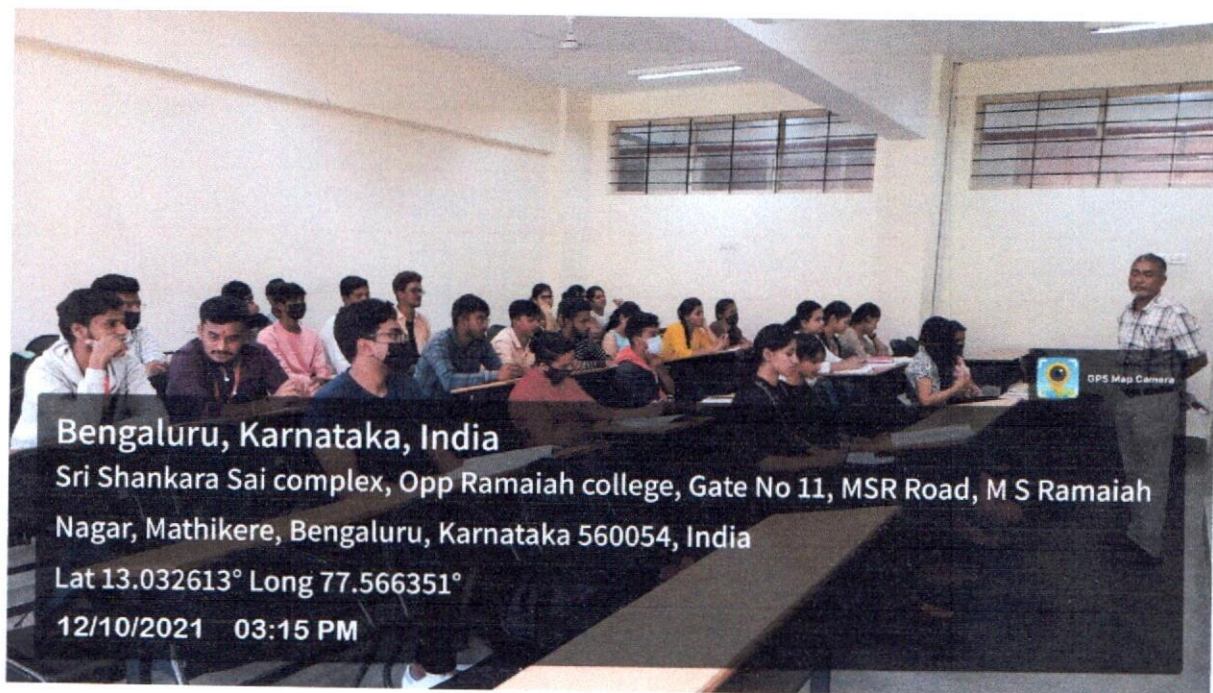
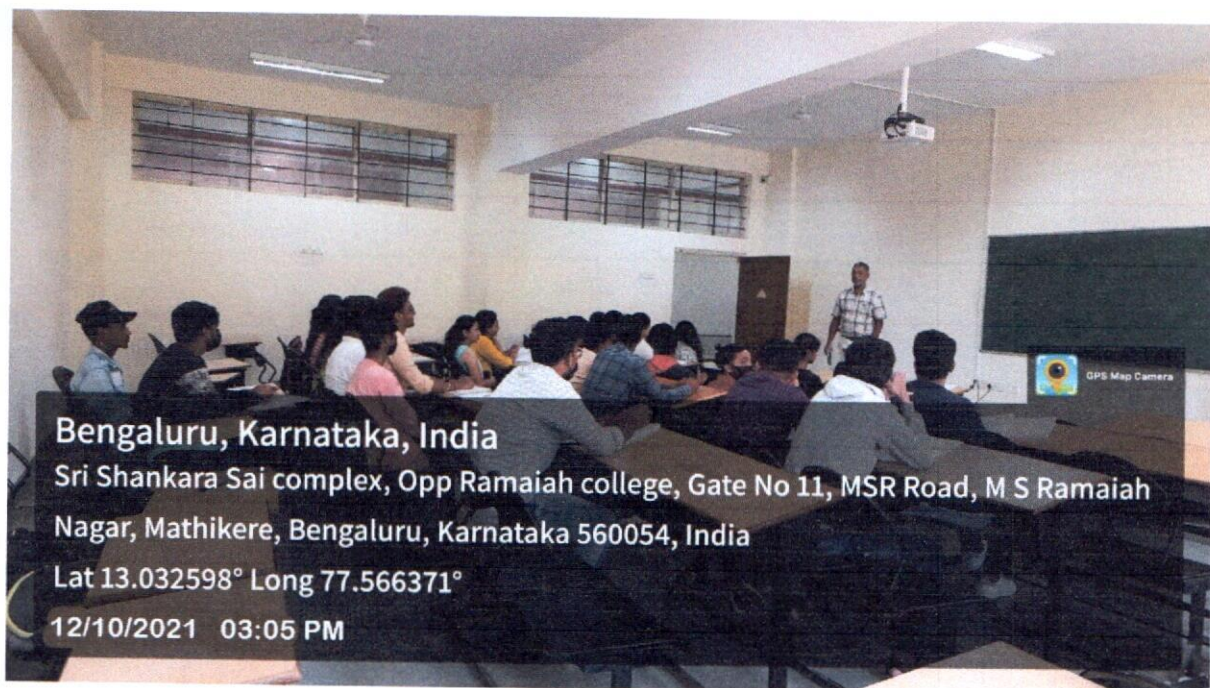
[ 4 ] Apply principles of matrix algebra to linear transformations.

**HEAD OF THE DEPARTMENT  
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Bangalore - 560 054**



**Value Added Course on “Linear Algebra and Singular value decomposition” Photos :**



*Heidi*  
Principal,  
M.S. Ramaiah College of Arts, Science & Commerce  
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DBT Star College Scheme

**DEPARTMENT: MATHEMATICS****Name of the Programme: Linear Algebra and Singular Value Decomposition****Year:- 2021-2022****Assessment Procedure for Value Added Program:**

Department of Mathematics organized value added course on Linear Algebra and Singular Value Decomposition from 12<sup>th</sup> October 2021 to 4<sup>th</sup> January 2022 for the students of 2<sup>nd</sup> year B.Sc.(EMCs) students by the resource person Mr.Ravindranath K. Total 22 students participated in this course and the course duration was 30 hours. During the training period, the students gained knowledge Linear Algebra and Singular Value Decomposition. Vector space are used to mathematically formulate and provide. The students actively participated in the training and also solved the problems given during the session on all the days of the training program. Also viva and MCQ test were conducted for the students by the resource person. Hence the students were given the participation certificate at the end of the program.

The following detail gives the marks of individual students.

Sl No	Student Name	Register Number	Attendance (10)	Quiz (MCQ)(20)	VIVA (10)	Total (40)
1	AKHILESH K	S2014618	10	20	10	40
2	BARNADEEP GUPTA	S2014621	10	19	9	38
3	DEEPTHI REDDY A R	S2014624	10	19	9	38
4	DISHA HEGDE	S2014625	10	20	10	40
5	GOVARDHAN B R	S2014626	10	19	10	39
6	HARIHARAN N S	S2014628	10	20	9	39
7	INDRA D	S2014629	10	19	9	38
8	KAMMARI SHREE HARI	S2014630	10	19	10	39
9	MIHIR A DIVAKAR	S2014633	10	20	10	40
10	MISBA NAAZ	S2014634	10	20	10	40
11	NIKHIL R	S2014635	10	19	9	38

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12	NISARGA H S	S2014636	10	20	10	40
13	NISHA A N	S2014637	10	20	10	40
14	RUCHITHA V	S2014643	10	20	10	40
15	SIVAPRASATH S	S2014646	10	20	10	40
16	SPOORTHI N	S2014647	10	10	9	39
17	SURABHI PRASAD	S2014648	10	20	10	40
18	THOTA PRADEEP	S1914649	10	20	10	40
19	V YADHU KRISHNA YADAV	S1914651	10	20	10	40
20	VENKATESHWARA PRASAD	S1914653	10	19	9	38
21	VINOD KUMAR BHEEMAPPA	S1914654	10	20	9	39
22	VISHNU R SANT	S1914655	8	19	9	36

**Outcome:** Through this value added course students will understand and learn the concepts of vector space and subspace. They will also understand and learn the concepts of eigenvalues and eigenvectors and solve eigenvalue problems.

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**DEPARTMENT: MATHEMATICS****Name of the Programme: Linear Algebra and singular value decomposition.****Year : 2021-2022****Assessment Procedure for Value Added Program: MCQ'S.**

1.  $M = \begin{pmatrix} 1 & 2 & 2 \\ 0 & 2 & 2 \\ 0 & 1 & 1 \end{pmatrix}$  and  $V = Mx^T: x \in R^3$ . Then  $\dim V$  is

(a) 0 (b) 1 (c) 2 (d) 3

2.  $A^2 - A = 0$  where A is a  $9 \times 9$  matrix. Then

(a) A must be a zero matrix (b) A is an identity matrix

(c) rank of A is 1 or 0

(d) A is diagonalizable

3. The number of linearly independent eigen vectors of  $\begin{pmatrix} 1 & 1 & 0 & 0 \\ 2 & 2 & 0 & 0 \\ 0 & 0 & 3 & 0 \\ 0 & 0 & 5 & 5 \end{pmatrix}$  is

(a) 1 (b) 2 (c) 3 (d) 4

4. A is a unitary matrix. Then eigen value of A are

(a) 1, -1 (b) 1, -i (c) i, -i (d) -1, i

5. Rank of the matrix is

(a) 2 (b) 3 (c) 4 (d) 5

6. The dimension of the subspace of  $M_{2 \times 2}$  spanned by  $\begin{pmatrix} 1 & -5 \\ -4 & 2 \end{pmatrix}, \begin{pmatrix} 1 & 1 \\ -1 & 5 \end{pmatrix}$  and  $\begin{pmatrix} 2 & -4 \\ -5 & 7 \end{pmatrix}$  is

Principal,

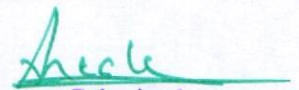
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- (a) 1 (b) 2 (c) 3 (d) 4
7.  $U$  and  $V$  are subspace of  $R^4$  such that  
 $U = \text{span} [(1,2,3,4), (5,7,2,1), (3,1,4,-3)]$   
 $V = \text{span} [(2,1,2,3), (3,0,1,2), (1,1,5,3)]$ .  
 Then the dimension of  $U \cap V$  is  
 (a) 1 (b) 2 (c) 3 (d) 4
8. Let  $M_{n \times n}$  be the set of all  $n$ -square symmetric matrices and the characteristics polynomial of each  $A \in M_{n \times n}$  is of the form  
 $t^n + t^{n-2} + a_{n-3}t^{n-3} + \dots + a_1 t + a_0$  Then the dimension of  $M_{n \times n}$  over  $R$  is  
 (a)  $\frac{(n-1)n}{2}$  (b)  $\frac{(n-2)n}{2}$  (c)  $\frac{(n-1)(n+2)}{2}$  (d)  $\frac{(n-1)^2}{2}$
9.  $A$  is a  $3 \times 3$  matrix with  $\sigma(A) = 1, -1, 0$ . Then  $|I + A^{100}|$  is  
 (a) 6 (b) 4 (c) 9 (d) 100
10.  $A$  is  $5 \times 5$  matrix, all of whose entries are 1, then  
 (a)  $A$  is not diagonalizable (b)  $A$  is idempotent (c)  $A$  is nilpotent
11.  $A$  is an upper triangular with all diagonal entries zero, then  $I + A$  is  
 (a) invertible (b) idempotent (c) singular (d) nilpotent
12. Number of linearly independent eigen vectors of  $\begin{pmatrix} 2 & 2 & 0 & 0 \\ 2 & 1 & 0 & 0 \\ 0 & 0 & 3 & 0 \\ 0 & 0 & 1 & 4 \end{pmatrix}$  is  
 (a) 1 (b) 2 (c) 3 (d) 4
13.  $M$  is a 2-square matrix of rank 1, then  $M$  is  
 (a) diagonalizable and non singular (b) diagonalizable and nilpotent  
 (c) neither diagonalizable nor nilpotent (d) either diagonalizable or nilpotent

  
 Principal,



14. A be a n-square matrix with integer entries and  $B=A+\frac{1}{2}I$ . Then  
 (a) B is idempotent (b)  $B^{-1}$  exist (c) B is nilpotent (d) B-I is idempotent

15. Let  $A \in M_{3 \times 3}$  then  $t^2 + 1$  is  
 (a) a minimal polynomial of A (b) a characteristics polynomial of A  
 (c) both (a) and (b) are true (d) none of (a) and (b) is true

16. A is a 4-square matrix and  $A^5 = 0$  Then  
 (a)  $A^4 = I$  (b)  $A^4 = A$  (c)  $A^4 = 0$  (d)  $A^4 = -I$

17. Let  $S=2-x+3x^2, x+x^2, 1-2x^2$  be subset of  $P_2(R)$  Then  
 (a) S is linearly independent (b) S is linearly dependent  
 (c)  $(2,-1,3), (0,1,1), (1,0,-2)$  are linearly dependent (d) S is a basis of  $P_2(R)$

18.  $T:P_2(R) \rightarrow P_3(R)$  such that  $T(f(x))=2f'(x)+3 \int_0^x f(t)dt$ . Then rank of T is  
 (a) 1 (b) 2 (c) 3 (d) 4

19.  $T:P_3(R) \rightarrow M_{2 \times 2}(R)$ , such that  $T(f(x)) = \begin{pmatrix} f(1) & f(2) \\ f(3) & f(4) \end{pmatrix}$ , then

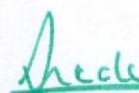
(a) T is 1-1 (b) T is onto (c) T is both 1-1 and onto (d) T is neither 1-1 nor onto

20.  $A \in M_{2 \times 2}(R)$  and rank of A is 1, then  
 (a) A is diagonalizable (b) A is nilpotent  
 (c) both (a) and (b) are true (d) none of (a) and (b) is true

The answers: 1)c, 2)d, 3)c, 4)c, 5)c, 6)b, 7)b, 8)c, 9)b, 10) d, 11)d, 12)d, 13)d, 14)b, 15)d, 16)c, 17)a, 18)c, 19)c, 20)b.



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# RAMAIAH COLLEGE OF ARTS, SCIENCE AND COMMERCE

## DEPARTMENT OF MATHEMATICS

### Value Added Course on Linear Algebra and Singular Value Decomposition

#### Attendance

**12<sup>th</sup> October 2021 to 4<sup>th</sup> January 2022 (30 Hrs)**

Sl.NO	Regt.No	Name	$\frac{12}{10}$	$\frac{13}{10}$	$\frac{26}{10}$	$\frac{27}{10}$	$\frac{2}{11}$	$\frac{9}{11}$	$\frac{10}{11}$	$\frac{11}{11}$	$\frac{12}{11}$	$\frac{16}{11}$	$\frac{17}{11}$	$\frac{23}{11}$	$\frac{24}{11}$	$\frac{25}{11}$	$\frac{26}{11}$
1	S2014618	AKHILESH K	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	S2014621	BARNADEEP GUPTA	1	2	3	4	5	6	7	0	8	9	10	11	12	13	14
3	S2014624	DEEPTHI REDDY A	1	2	3	4	0	5	6	7	8	9	10	11	12	13	14
4	S2014625	DISHA HEGDE	1	2	3	4	5	6	7	8	9	0	10	11	12	13	0
5	S2014626	GOVARDHAN B R	1	2	3	4	5	0	6	7	8	9	10	11	12	13	14
6	S2014628	HARIHARAN N S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
7	S2014629	INDRA D	1	0	2	3	4	5	6	7	8	9	10	11	12	0	13
8	S2014630	K SHREE HARI	1	2	3	4	5	6	7	8	0	9	10	11	12	13	14
9	S2014633	MIHIR A DIVAKAR	1	2	3	4	5	6	7	8	9	0	0	10	11	12	13
10	S2014634	MISBA NAAZ	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11	S2014635	NIKHIL R	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
12	S2014636	NISARGA H S	1	2	0	3	4	5	6	7	8	9	10	0	11	12	13
13	S2014637	NISHA A N	1	2	3	4	5	6	7	8	9	10	0	11	12	0	0
14	S2014643	RUCHITHA V	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
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18	S1914649	THOTA PRADEEP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	0
19	S1914651	V YADHU KRISHNA YADAV	1	2	3	4	5	6	7	8	9	10	11	0	12	13	14
20	S1914653	VENKATESHWAR A PRASAD	1	2	3	4	5	6	7	0	8	9	10	11	12	13	14
21	S1914654	VINOD KUMAR B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
22	S1914655	VISHNU R SANT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

*Heck*

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## DEPARTMENT OF MATHEMATICS

### Value Added Course on Linear Algebra and Singular Value Decomposition

#### Attendance

12<sup>th</sup> October 2021 to 4<sup>th</sup> January 2022 (30 Hrs)

SLNO	Regt.No	Name	$\frac{30}{11}$	$\frac{1}{12}$	$\frac{2}{12}$	$\frac{3}{12}$	$\frac{8}{12}$	$\frac{9}{12}$	$\frac{10}{12}$	$\frac{15}{12}$	$\frac{17}{12}$	$\frac{22}{12}$	$\frac{23}{12}$	$\frac{24}{12}$	$\frac{29}{12}$	$\frac{30}{12}$	$\frac{4}{01}$
1	S2014618	AKHILESH K	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
2	S2014621	BARNADEEP GUPTA	15	16	0	17	18	19	20	21	22	23	24	25	26	27	28
3	S2014624	DEEPTHI REDDY A	0	15	16	17	18	19	20	21	22	23	0	24	25	26	27
4	S2014625	DISHA HEGDE	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
5	S2014626	GOVARDHAN B R	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
6	S2014628	HARIHARAN N S	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
7	S2014629	INDRA D	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
8	S2014630	K SHREE HARI	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
9	S2014633	MIHIR A DIVAKAR	14	15	16	17	18	19	20	0	21	22	23	24	25	26	27
10	S2014634	MISBA NAAZ	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
11	S2014635	NIKHIL R	16	17	0	0	18	19	20	21	22	23	24	25	26	27	28
12	S2014636	NISARGA H S	14	15	16	17	18	19	20	0	21	22	23	24	25	26	27
13	S2014637	NISHA A N	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
14	S2014643	RUCHITHA V	16	17	18	19	0	0	20	21	0	22	23	24	25	26	27
15	S2014646	SIVAPRASATH S	16	17	18	19	20	21	22	23	24	25	26	0	0	27	28
16	S2014647	SPOORTHIN	16	17	18	19	20	21	22	23	24	25	26	0	27	28	29
17	S2014648	SURABHI PRASAD	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
18	S1914649	THOTA PRADEEP	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
19	S1914651	V YADHU KRISHNA YADAV	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
20	S1914653	VENKATESHWAR A PRASAD	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
21	S1914654	VINOD KUMAR B	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
22	S1914655	VISHNU R SANT	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

*Heck*

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