



MUGBERIA GANGADHAR MAHAVIDYALAYA

P.O.—BHUPATINAGAR, Dist.—PURBA MEDINIPUR, PIN.—721426, WEST BENGAL, INDIA

NAAC Re-Accredited B+Level Govt. aided College

CPE (Under UGC XII Plan) & NCTE Approved Institutions

DBT Star College Scheme Award Recipient

E-mail : mugberia_college@rediffmail.com // www.mugberiagangadharmahavidyalaya.ac.in

Report

On

Numerical Computation using MATLAB and LINGO software's

Organized by

The Department of Mathematics (UG & PG)


MugberiaGangadharMahavidyalaya

<https://twitter.com/Swapank26545954/status/1682760198107303937?t=Fue6IqrP4wXa5IY0QXVc4A&s=08>

Dated: 22.07.2023

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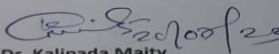
 **MUGBERIA GANGADHAR MAHAVIDYALAYA**
P.O.—BHUPATINAGAR, Dist.—PURBA MEDINIPUR, PIN.—721425, WEST BENGAL, INDIA
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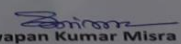
Date: 20.07.2023


Department of Mathematics

Students are hereby informed that the Practical Examination on Paper MTM-495B(OR Methods using MATLAB & LINGO) of PG 4th SEM in Mathematics will be held on 22th July 2023 as per following schedule. Students are directed to note the details as follows and attend the same positively.

Date of Examination: 22.07.2023 at 11.00 AM
Venue: Computer Lab, Dept of Mathematics
Internal Examiner: Subham Maity, Contractual Teacher
External Examiner: Dr. Jayanta Kumar De, Associate Professor, Dept of Mathematics, Mahisadal Raj College.


Dr. Kalipada Maity
Head, Department of Mathematics
Mugberia Gangadhar Mahavidyalaya


Dr. Swapan Kumar Misra
Principal
Mugberia Gangadhar Mahavidyalaya



NOTICE

Mugberia Gangadhar Mahavidyalaya
Bhupatinagar, Purba Medinipur, 721425, West Bengal
Attendance Sheet / Submission of Answer Scripts

Examination: MS Final Exam Year: 2023 Semester: IV Date: 22-07-2023
B.A/B.Sc/B.Com.(Hons./Gen.) Subject: Applied Mathematics Paper: MTM-495 (B)

SLNo	Name of Candidate	Roll	No.	Signature of Candidate with date
1	Shrabani Jana	Pg/VUEG532/MTM-IVS	0079	S. Jana 22.07.23
2	Suchismita Pradhan	Pg/VUEG532/MTM-IVS	0084	S. Pradhan, 22.07.23
3	Rishi Das Athi Kasi	Pg/VUEG532/MTM-IVS	0067	P.D.A., 22.07.23
4	Shreya Jana	Pg/VUEG532/MTM-IVS	0080	S. Jana, 22.7.23
5	Sanchayan Laha	Pg/VUEG532/MTM-IVS	0071	S. Laha 22.07.23
6	Sayan Das	Pg/VUEG532/MTM-IVS	0093	S. Das, 22.07.23
7	Biswarjit Mondal	Pg/VUEG532/MTM-IVS	0055	B. Mondal 22.07.23
8	Debasmita Maity	Pg/VUEG532/MTM-IVS	0058	D. Maity 22.07.23
9	Raja Kumar Shee	Pg/VUEG532/MTM-IVS	0069	R. K. Shee 22/07/23
10	Subhadip Mandal	Pg/VUEG532/MTM-IVS	0081	Subhadip Mandal, 22/07/23
11	Debatrata Patra	Pg/VUEG532/MTM-IVS	0057	Debatrata Patra, 22/07/23
12	Goutam Jana	Pg/VUEG532/MTM-IVS	0060	Goutam Jana, 22/07/23
13	Amiya Mandal	Pg/VUEG532/MTM-IVS	0051	Amiya Mandal, 22.7.23
14	Prodyot Dalapati	Pg/VUEG532/MTM-IVS	0066	Prodyot Dalapati
15	Subinay Patra	Pg/VUEG532/MTM-IVS	0083	Subinay Patra
16	Buddhadev Jana	Pg/VUEG532/MTM-IVS	0056	Buddhadev Jana
17	Sahab Bera	Pg/VUEG532/MTM-IVS	0032	Sahab Bera
18	Bijaya Patra	Pg/VUEG532/MTM-IVS	0054	Bijaya Patra 22.7.23
19	Saikat Jana	Pg/VUEG532/MTM-IVS	0070	Saikat Jana 22.07.2023
20	Sacharish Ghosh	Pg/VUEG532/MTM-IVS	0097	Sacharish Ghosh, 22.07.23
21	Subhamay Das	Pg/VUEG532/MTM-IVS	0082	Subhamay Das
22	Poushali Tripathy	Pg/VUEG532/MTM-IVS	0065	P. T.
23	Topasi Karan	Pg/VUEG532/MTM-IVS	0091	Topasi Karan
24	Snigdha Mandal	Pg/VUEG532/MTM-IVS	0098	Snigdha Mandal
25	Sumana Maity	Pg/VUEG532/MTM-IVS	0095	Sumana Maity
26	Samyakt Mandal	Pg/VUEG532/MTM-IVS	0094	Samyakt Mandal
27	Subananda Sam	Pg/VUEG532/MTM-IVS	0068	Sam 22.07.23

Signature of Teacher/Invigilator: S. Maity Date: 22.07.2023
Centre-in-Charge/Principal: S. Maity Date: 22/07/23

Mugberia Gangadhar Mahavidyalaya
Bhupatinagar, Purba Medinipur, 721425, West Bengal
Attendance Sheet / Submission of Answer Scripts

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B.A/B.Sc/B.Com.(Hons./Gen.) Subject: Applied Mathematics Paper: MTM-495 (B)

SLNo	Name of Candidate	Roll	No.	Signature of Candidate with date
28	Sudeshma Maity	Pg/VUEG532/MTM-IVS	2585	Sudeshma Maity 22.07.2023
29	Susmita Sahoo	Pg/VUEG532/MTM-IVS	2590	Susmita Sahoo 22.07.2023
30	Prishendu Pradhan	Pg/VUEG532/MTM-IVS	2562	Prishendu Pradhan 22.07.2023
31	Diptaraj Patra	Pg/VUEG532/MTM-IVS	2593	Diptaraj Patra 22.07.2023

Signature of Teacher/Invigilator: S. Maity Date: 22.07.2023
Centre-in-Charge/Principal: S. Maity Date: 22/07/23

List of presented students is given above

Group-A (LINGO) 1 x 6= 06

1. Write a code in LINGO to solve the following QPP using Wolfe's modified simplex method.

$$\begin{aligned} \max z &= 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2 \\ \text{subject to, } x_1 + 2x_2 &\leq 2 \\ x_1, x_2 &\geq 0 \end{aligned}$$

2. Write a code in LINGO to solve the Nash equilibrium strategy and Nash equilibrium outcome of the following bi-matrix game.

$$A = \begin{bmatrix} 1 & 0 \\ 2 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 3 & 2 \\ 0 & 1 \end{bmatrix}$$

3. Write a code in LINGO to solve the following problem of Inventory.

An engineering factory consumes 5000 units of a component per year. The ordering, receiving and handling cost are Rs.300 per order while trucking cost is Rs.1200 per order, internet cost Rs. 0.06 per unit per year, Deterioration and obsolescence cost Rs 0.004 per year and storage cost Rs. 1000 per year for 5000 units. Calculate the economic order quantity and minimum average cost.

4. Write a code in LINGO to solve the following Stochastic Programming Problem.

A manufacturing firm produces two machines parts using lathes, milling machines and grinding machines. The machining times available per week on different machines and the profit on machine part are given below. The machining times required on different machines for each part are not known precisely (as they vary from worker to worker) but are known to follow normal distribution with mean and standard deviations as indicated in the following table.

Page 1 of 5

Type of Machine	Machining time required per unit(minutes)				Maximum time available per week (minutes)
	Part I		Part II		
	Mean	Standard deviation	Mean	Standard deviation	
Lathes	$\bar{a}_{11}=10$	$\sigma_{a11}=6$	$\bar{a}_{12}=4$	$\sigma_{a12}=4$	$b_1=2500$
Milling machines	$\bar{a}_{21}=4$	$\sigma_{a21}=6$	$\bar{a}_{22}=10$	$\sigma_{a22}=7$	$b_2=2000$
Grinding machine	$\bar{a}_{31}=1$	$\sigma_{a31}=2$	$\bar{a}_{32}=1.5$	$\sigma_{a31}=3$	$b_3=450$
Profit per unit(Rs)	$c_1=50$		$c_2=100$		

Determine the number of machine parts I and II to be manufactured per week to maximize the profit without exceeding the available machining times more than once in 100 weeks.

5. Write a code in LINGO to solve the following LPP using simplex method.

$$\begin{aligned} \max z &= 2x_1 + 3x_2 - x_3 \\ \text{subject to, } 2x_1 + 5x_2 - x_3 &\leq 5 \\ x_1 + x_2 + 2x_3 &= 6 \\ 2x_1 - x_2 + 3x_3 &= 7 \\ x_1, x_2 &\geq 0 \end{aligned}$$

6. Write a code in LINGO to solve the following QPP using Wolfe's modified simplex method.

$$\begin{aligned} \max z &= 2x_1 + 3x_2 - x_1^2 \\ \text{subject to, } x_1 + 2x_2 &\leq 4 \\ x_1, x_2 &\geq 0 \end{aligned}$$

7. Write a code in LINGO to solve the following Geometric Programming Problem.

$$\min f(x) = 5x_1x_2^{-1} + 2x_1^{-1}x_2 + 5x_1 + x_2^{-1}$$

Page 2 of 5

8. Write a code in LINGO to solve the following Queuing theorem problem.

A telephone exchange has two long distance operators. The telephone company finds that, during the peak load long distance all arrive in a Poisson fashion at an average rate of 15 per hour. The length of service on this call is approximately exponentially distributed with mean length 5 minutes.

- (a) What is the probability that a subscriber will have to wait for this long distance call during the peak hours of the day?
(b) If the subscriber waits and are serviced in turn, what is the expected waiting time.

Group-B (MATLAB)

Answer any one 1X 9=09

1. Write a code in MATLAB to solve the following problems of Inventory.

A constructor has to supply 10,000 bearing per day to an automobile manufacturer. He find that when he start a production run, he can produce 25,000 bearing per day. The cost of holding a bearing in stock for one year is Rs 2 and set up cost for producing run is Rs 180. How frequently should the production ?

2. Write a code in MATLAB to solve the following Stochastic Programming Problem.

A manufacturing firm produces two machines parts using lathes, milling machines and grinding Write a program in MATLAB to solve machines. The machining times required on different machines for each part and the profit on machine part are given below. If the machining times available on different machines are probabilistic (normally distributed) with parameters as given in the following table , find the number of machine parts I and II to b

Page 3 of 5

manufactured per week to maximize the profit. The constraint have to be satisfied with a probability of at least 0.99.

Type of Machine	Machining time required per piece (minutes)		Maximum time available per week (minutes)	
	Part I	Part II	Mean	Standard deviation
Lathes	$a_{11}=10$	$a_{12}=5$	$b_1=2500$	$\sigma_{b1}=500$
Milling Machines	$a_{21}=4$	$a_{22}=10$	$b_2=2000$	$\sigma_{b2}=400$
Grinding Machines	$a_{31}=1$	$a_{32}=1.5$	$b_3=450$	$\sigma_{b3}=50$
Profit per unit(Rs)	$c_1=50$		$c_2=100$	

3. Write a code in MATLAB to solve the following problem of Inventory.

The demand for an item in a company is 18000 units per year. The company can produce the item at a rate of 3000 per month. The cost of one set-up is Rs. 500 and the holding cost of one unit per month is Rs. 0.15. The shortage cost of one unit is Rs. 20 per month. Determine the optimum manufacturing quantity. Also determine the manufacturing time and the time between setup.

4. Write a code in MATLAB to solve the following LPP using simplex method.

$$\begin{aligned} \max z &= 3x_1 + 4x_2 \\ \text{subject to, } x_1 + x_2 &\leq 10 \\ 2x_1 + 3x_2 &\leq 18 \\ x_1 &\leq 8 \\ x_2 &\leq 6 \\ x_1, x_2 &\geq 0 \end{aligned}$$

5. Write a code in MATLAB to solve the following QPP using Wolfe's modified simplex method.

$$\begin{aligned} \max z &= 2x_1 + x_2 - x_1^2 \\ \text{subject to, } 2x_1 + 3x_2 &\leq 6 \end{aligned}$$

Page 4 of 5

$$\begin{aligned} 2x_1 + x_2 &\leq 4 \\ x_1, x_2 &\geq 0 \end{aligned}$$

6 Write a code in MATLAB to solve the following Geometric Programming Problem.

$$\min f(x) = 5x_1x_2^{-1}x_3^2 + x_1^{-2}x_2^{-1} + 10x_2^2 + 2x_1^{-1}x_2x_3^{-2}$$

7. Write a code in MATLAB to find the Nash equilibrium strategy and Nash equilibrium outcome of the following bi-matrix game.

$$A = \begin{bmatrix} 1 & 0 \\ 2 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 3 \\ 1 & 0 \end{bmatrix}$$

8. Write a code in MATLAB to solve the following Queuing theorem problem.

In a car wash service facility information gather indicates that cars arrive for service according to a Poisson distribution with mean 5 per hour. The time for washing and cleaning for each car varies but is found to follow an exponential distribution with mean 10 minutes per car. The facility cannot handle more than one car at a time and has a total of 5 parking spaces. If the parking spot is full, newly arriving cars balk to 6 services elsewhere.

- How many customers the manager of the facility is loosing due to the limited parking spaces?
- What is the expected waiting time until a car is washed?

Laboratory Note Book and Viva:	05
Field Tour with Report:	05

The questions paper of this examination:

A-4872
B-4

Serial No. A1758265

বিদ্যাসাগর বিশ্ববিদ্যালয়
VIDYASAGAR UNIVERSITY

যথাযথ প্রতিপাদনে প্রতিস্বাক্ষরিত
Countersigned on verification

উৎসাহমূলক মুদ্রিত নির্দেশাবলী পরীক্ষার্থীকে অবশ্যই পালন করিতে হইবে।
Candidate must follow all instructions printed on reverse.

পরীক্ষাকেন্দ্রের অধিকর্তার স্বাক্ষর
Signature of the Officer-in-Charge

পরীক্ষার্থীকে পূরণ করিতে হইবে।
To be filled in by the candidate

পরীক্ষা: ২০ Examination: PG 4th Sem Exam 2023
পরীক্ষার্থীর রোল নং: Candidate's Roll No. 0065
কেন্দ্রের সহ রেজিস্ট্রেশন নং: Regn. No. with year: 1201010-2018-2019
বিষয়: Mathematics
পত্র: Paper 495-B
অর্ধ: Half 1st

প্রশ্নের ক্রমিক সংখ্যা Question No.	প্রাপ্ত নম্বর Marks Obtained	মোট প্রাপ্ত নম্বর Total Marks Obtained
১	5	24
২	5	
৩	5	
৪	5	

প্রধান পরীক্ষক
Head Examiner

সমন্বয়সম্পন্নকারী
Co-ordinator

সহায়ক পরীক্ষক
Scrutinizer

পরীক্ষক
Examiner

1758265

Group-B

4. Write a code in MATLAB to solve the following LPP using simplex method.

Max $Z = 3x_1 + 4x_2$

Subject to,

$$\begin{aligned} x_1 + x_2 &\leq 10 \\ 2x_1 + 3x_2 &\leq 18 \\ x_1 &\leq 8 \\ x_2 &\leq 6 \\ x_1, x_2 &\geq 0 \end{aligned}$$

MATLAB

$f = [3 \ 4];$

$b = [10 \ 18];$

$f = [3, -4];$

$A = [1 \ 1; 2 \ 3];$

$b = [10; 18];$

$Aeq = [\quad];$

$b eq = [\quad];$

1758265

$$lb = [0, 0];$$

$$ub = [8, 6];$$

$$[x, fval] = \text{linprog}(f, A, b, Aeq, beq, lb, ub);$$

Optimal - value = fval

$$Sol = x$$

Output

Optimization terminated,
Optimum value = 26.6667

Sol =

8.0000

0.6667

79

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Group-A

7. Write a code in LINGO to solve the following Geometric Programming problem.

$$\min f(x) = 5x_1x_2^{-1} + 2x_1^{-1}x_2 + 5x_1 + x_2^{-1}$$

LINGO

$$\text{Min} = Z;$$

$$Z = (5/C_1)^{1/C_1} \cdot (2/C_2)^{1/C_2} \cdot (5/C_3)^{1/C_3} \cdot (1/C_4)^{1/C_4}$$

$$C_1 + C_2 + C_3 + C_4 = 1;$$

$$1 \cdot C_1 + 0 \cdot C_2 - 1 \cdot C_3 + 1 \cdot C_4 = 0;$$

$$-1 \cdot C_1 + 1 \cdot C_2 + 0 \cdot C_3 - 1 \cdot C_4 = 0;$$

$$5 + x_1/x_2 = Z \cdot C_1;$$

$$2/x_1 + x_2 = Z \cdot C_2;$$

$$5 + x_1 = Z \cdot C_3;$$

$$1/x_2 = Z \cdot C_4;$$

2888051

Output

Solution is locally infeasible

Infeasibilities : 5.029734

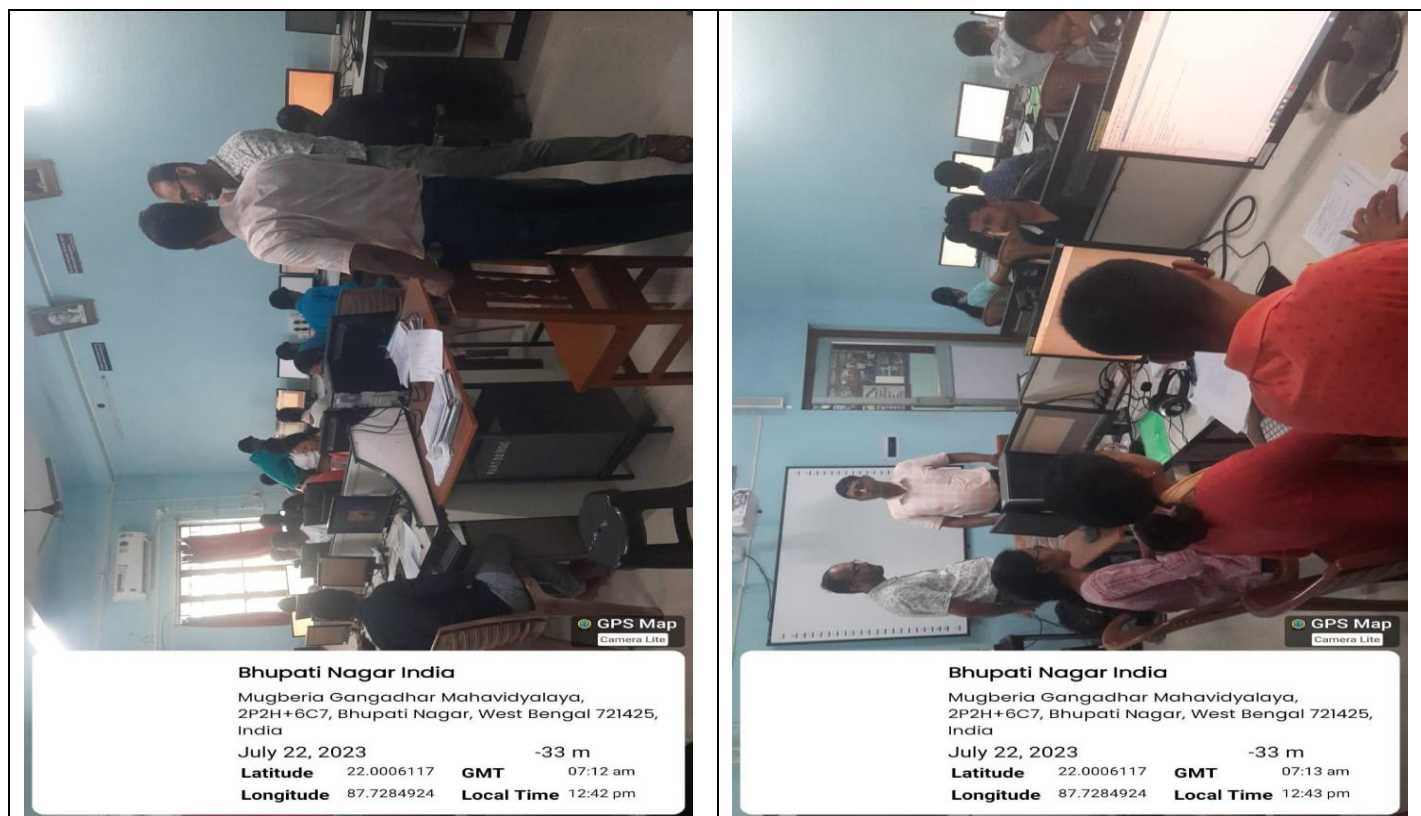
Total Solver iterations: 20

variable	value	Reduced cost
Z	-6.324555	0.000000
C1	0.5000000	0.000000
C2	0.5000000	0.000000
C3	0.000000	0.000000
C4	0.000000	0.000000
x1	0.1257433	0.000000
x2	0.1988177	0.000000

PS

Run Solver 22/07/23

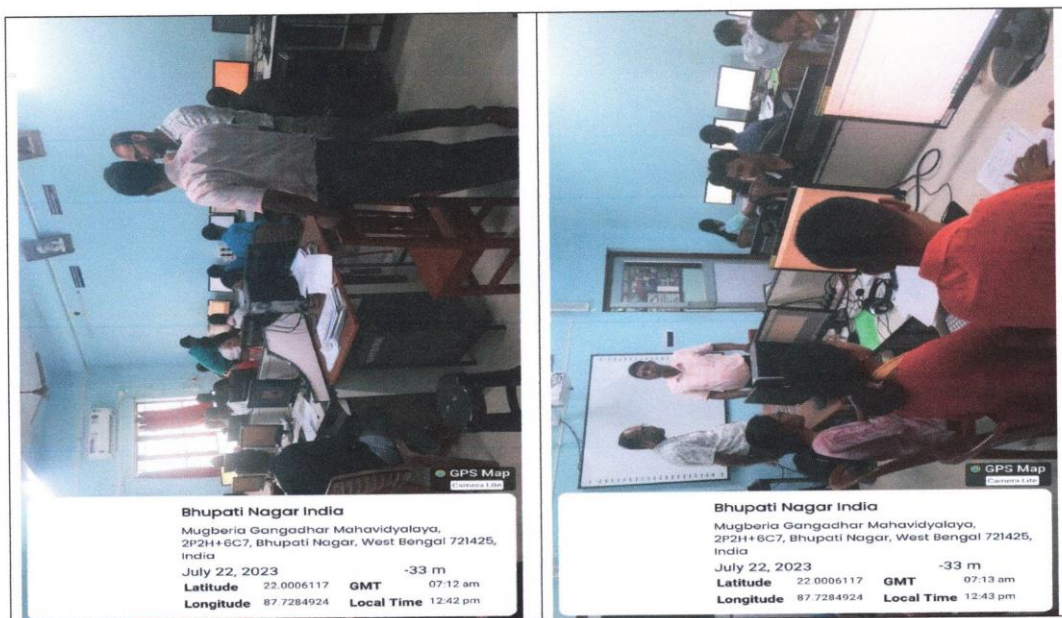
Sample of one answer script of this examination



GPS Pictures

<https://twitter.com/Swapank26545954/status/1682760198107303937?t=Fue6IqrP4wXa5IY0QXVc4A&s=08>

Conclusion: The Practical examination on **Numerical Computation using MATLAB and LINGO software's** (paper MTM-495 (B)) was held on 22nd July 2023 at 11.00 a.m to 2.00 p.m in Mathematics Department Lab. In this program, the 31 students of PG 4th semester of Mathematics Department have been participated to this examination. In this hand on experiment, Dr. Jayanta Kumar De, Associate Professor of Dept. of Mathematics, Mahisadal Raj College was external examiner and Dr. Manoranjan De & Mr. Subham Maity were the internal examiners. Finally, Dr. Kalipada Maity , HOD Dept. of Mathematics thanks to all students and faculty members.



GPS Pictures

<https://twitter.com/Swapank26545954/status/1682760198107303937?t=Fue6IqrP4wXa5IY0QXVc4A&s=08>

Conclusion: The Practical examination on **Numerical Computation using MATLAB and LINGO software's** (paper MTM-495 (B)) was held on 22nd July 2023 at 11.00 a.m to 2.00 p.m in Mathematics Department Lab. In this program, the 31 students of PG 4th semester of Mathematics Department have been participated to this examination. In this hand on experiment, Dr. Jayanta Kumar De, Associate Professor of Dept. of Mathematics, Mahisadal Raj College was external examiner and Dr. Manoranjan De & Mr. Subham Maity were the internal examiners. Finally, Dr. Kalipada Maity , HOD Dept. of Mathematics thanks to all students and faculty members.



Dr. Swapan Kumar Misra 24.7.23
Principal
Principal
Mugberia Gangadhar Mahavidyalaya