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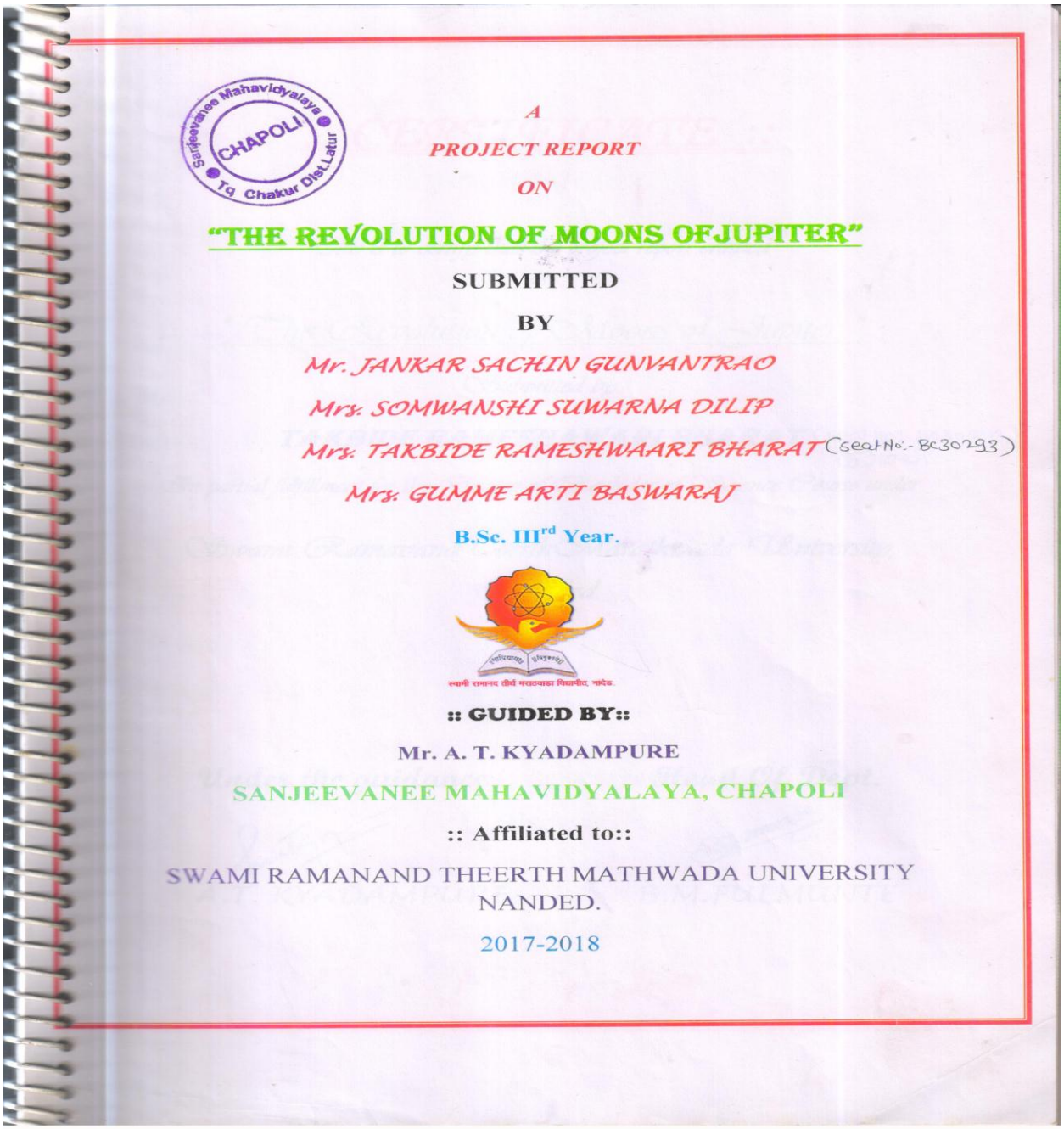

Sanjeevanee Mahavidyalaya CHAPOLI Tq Chakur Dist.Latur

A

PROJECT REPORT

ON

"THE REVOLUTION OF MOONS OFJUPITER"

SUBMITTED

BY

Mr. JANKAR SACHIN GUNVANTRAO

Mrs. SOMWANSHI SUWARNA DILIP

Mrs. TAKBIDE RAMESHWAARI BHARAT (Seat No.- Bc30293)

Mrs. GUMME ARTI BASWARAJ

B.Sc. III[rd] Year.

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड.

:: GUIDED BY::

Mr. A. T. KYADAMPURE

SANJEEVANEE MAHAVIDYALAYA, CHAPOLI

:: Affiliated to::

SWAMI RAMANAND THEERTH MATHWADA UNIVERSITY
NANDED.

2017-2018

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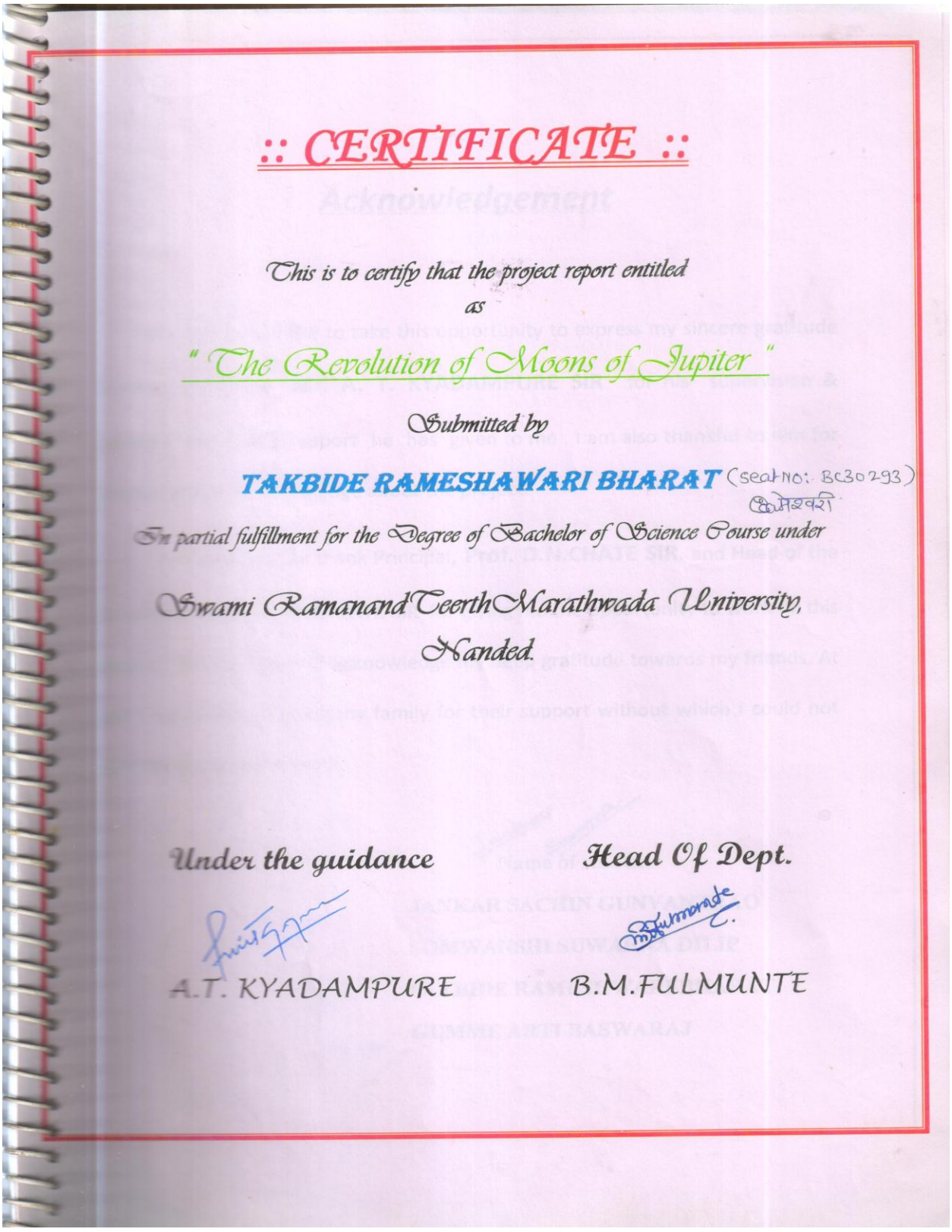

:: CERTIFICATE ::

This is to certify that the project report entitled

as

"The Revolution of Moons of Jupiter"

Submitted by

TAKBIDE RAMESHAWARI BHARAT (seat no: BC30293)

रामेश्वरी

In partial fulfillment for the Degree of Bachelor of Science Course under

Swami Ramanand Teerth Marathwada University,

Nanded.

Under the guidance

A.T. KYADAMPURE

Head Of Dept.

B.M.FULMUNTE

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Acknowledgement

Firstly I would like to take this opportunity to express my sincere gratitude towards my Guide **Mr. A. T. KYADAMPURE SIR** for his supervision & guidance and timely support he has given to me . I am also thankful to him for providing all basic knowledge about the project.

It is my honor to thank Principal, **Prof. D.N.CHATE SIR.** and Head of the Department **Mr. B. FULMUNTE SIR** for giving me the opportunity to work on this project. Finally, I wish to acknowledge my deep gratitude towards my friends. At last I would like to thank my family for their support without which I could not able to complete this work.

Jankar Suwarna.

Name of student

JANKAR SACHIN GUNVANTRAO

SOMWANSHI SUWARNA DILIP

TAKBIDE RAMESHWARI BHARAT

GUMME ARTI BASWARAJ

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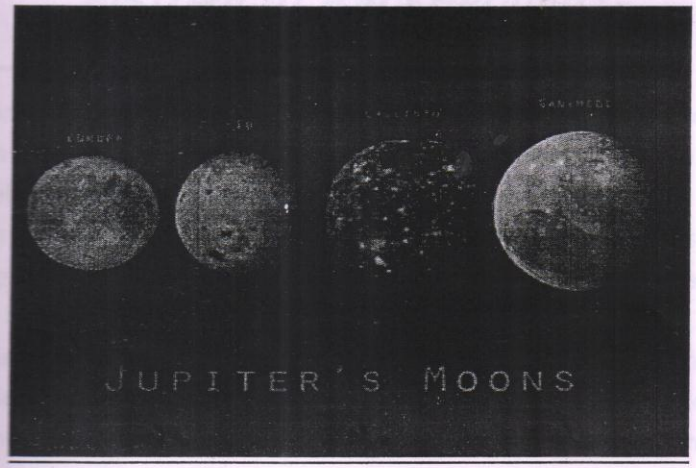
INTRODUCTION : -

We will observe the four moons Jupiter .That Galileo saw through his telescope known today as the Gallilean moons. They are named to Europa, Ganymede and Callisto, in order of distance from Jupiter. you can remember the order by the Memorices "I eat green carrot".



Jupiter have four moons EUROPA, I_O, CALLISTO & GANYMEDE respectively in size.

EQUIPMENT : -

This experiment uses a Windows computer, the CLEA program, the revolution of the Moons Jupiter and a scientific calculator.

HISTORICAL BACKGROUND : -

Astronomers cannot directly measure many of the things they study such as the masses never the less we can deduce some properties celestial bodies from their motions despite the fact that we cannot directly measure them in 1543 Nicholas Copernicus hypothesized that The planet revolve in circular orbits around the sun Tycho Brahe (1546 – 1601) Carefully observe the locations of the planets and 777 stars Over a period of 20 years using sextant and compass. These observations were used By Johns Kepler, a student of Brahe to deduce three emperical Mathematical laws governing the orbit of One object around another Kepler's third law Is the one that applies to this lab for a moon orbiting much more massive Parent body, It states the following.

$$M = \frac{a^3}{P^2}$$

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Where,

M - Is the Mass of Parent body in units of the mass of the Sun.

a - The length of the Semi-major axis in units of the mean Earth Sun distance I.A.U. (Astronomical unit). If the orbit is circular (As we assume in the lab). The semi-major axis is equal to the radius of the orbit.

P - Is the period of the orbit in earth years. The period is the amount of the time required for the moon to orbit the parent body once.

In 1609, the telescope was invented allowing the observation of object not visible to the naked eye Galileo used a telescope to discover that Jupiter had four moons orbiting it and made exhaustive studies of this system which was especially remarkable because the Jupiter system is a miniature version of the solar system. studying such a could open a way to understand the motions of the solar system provided clear evidence that Copernicus heliocentric model of the solar system was physically possible. Unfortunately for Galileo, the inquisition took issue with his findings he was tried and forced to recant.

OBSERVATION TABLE : -

Sr. No.	Julian Date	POSITION OF THE SATELITE			
		Io	GANYMEDE	CALLISTO	EUTOPA
1	2458031.5	1.25 W	6.10 W	12.40 E	2.05 W
2	2458031.66667	-----	6.7 W	12.15 E	3.20 W
3	2458031.83333	2.05 E	7.04 W	11.7 E	4.0 W
4	2458032.00	2.9 E	7.4 W	11.3 E	4.5 W
5	2458032.16665	2.5 E	7.5 W	11.3 E	4.6 W
6	2458032.33333	1.9 E	7.5 W	10.95 E	4.15 W
7	2458032.5000	-----	7.15 W	10.45 E	3.44 W
8	2458032.66667	1.5 W	6.85 W	9.95 E	2.55 W
9	2458032.83333	2.55 W	6.35 W	9.35 E	1.35 W
10	2458033.00	2.8 W	5.70 W	8.75 E	-----
11	2458033.166667	2.10 W	4.85 W	8.05 E	1.55 E
12	2458033.33333	0.60 W	4.15 W	7.40 E	2.70 E
13	2458033.5000	0.95 E	3.05 W	6.7 E	3.60 E
14	2458033.66667	2.40 E	2.05 W	5.95 E	4.45 E
15	2458033.83333	2.95 E	1.1 W	5.25 E	4.85 E
16	2458034.00	2.6 E	-----	4.4 E	4.65 E
17	2458034.166667	1.25 E	1.20 E	3.75 E	4.20 E
18	2458034.33333	0.40 W	2.25 E	2.75 E	3.45 E
19	2458034.5000	2.0 W	3.20 E	2.05 E	2.40 E
20	2458034.66667	2.8 W	-----	1.20 E	1.15 E
21	2458034.83333	2.6 W	-----	-----	0.2 W
22	2458035.000	1.7 W	-----	-----	1.55 W
23	2458035.16667	0.15 W	-----	-----	2.75 W
24	2458035.3333	1.6 E	-----	-----	3.65 W
25	2458035.5000	2.75 E	7.35 E	3.65 W	4.35 W
26	2458035.66667	3.05 E	-----	-----	4.60 W
27	2458035.8333	2.20 E	-----	-----	4.35 W
28	2458036.00	0.7 E	-----	-----	3.8 W
29	2458036.16667	1.05 W	-----	-----	2.90 W
30	2458036.3333	2.45 W	-----	-----	1.75 W
31	2458036.5000	2.90 W	6.15 E	8 W	0.40 W
32	2458036.66667	2.45 W	-----	-----	1.05 W
33	2458036.8333	1.05 W	-----	-----	2.30 E

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34	2458037.00	0.60 E	-----	-----	3.4 E
35	2458037.166667	2.2 E	-----	-----	4.3 E
36	2458037.3333	2.95 E	-----	-----	4.75 E
37	2458037.500	2.80 E	0.65 E	11.30 W	4.80 E
38	24580366667	1.70 E	-----	-----	4.45 E
39	2458037.8333	0.05 W	-----	-----	3.90 E
40	2458038.00	1.55 W	-----	-----	2.85 E
41	2458038.500	2.00 W	5.25 W	12.95 W	1.10 W
42	2458039.500	1.10 E	7.45 W	12.90 W	4.00 W
43	2458040.500	-----	4.20 W	11.05 W	3.00 W
44	2458041.500	1.15 W	2.00 E	7.65 W	3.15 E
45	2458042.500	2.35 E	6.90 E	3.25 W	3.90 W
46	2458043.500	2.75 W	6.75 E	1.50 E	1.25 W
47	2458044.500	3.00 E	1.85 E	-----	4.85 E
48	2458045.500	2.5 W	4.35 E	-----	0.150 E
49	2458046.500	1.9 E	7.5 W	-----	4.50 W
50	2458047.500	0.7 W	5.2 W	-----	2.15 E
51	2458048.500	0.4 W	0.8 E	-----	3.8 E
52	2458049.500	1.55 E	6.30 E	-----	3.4 E
53	2458050.500	2.4 W	7.25 E	-----	2.2 W
54	2458051.500	2.99 E	3.0 E	-----	4.60 E
55	2458052.500	2.75 W	3.3 W	-----	0.75 E

CALCULATIONS : -

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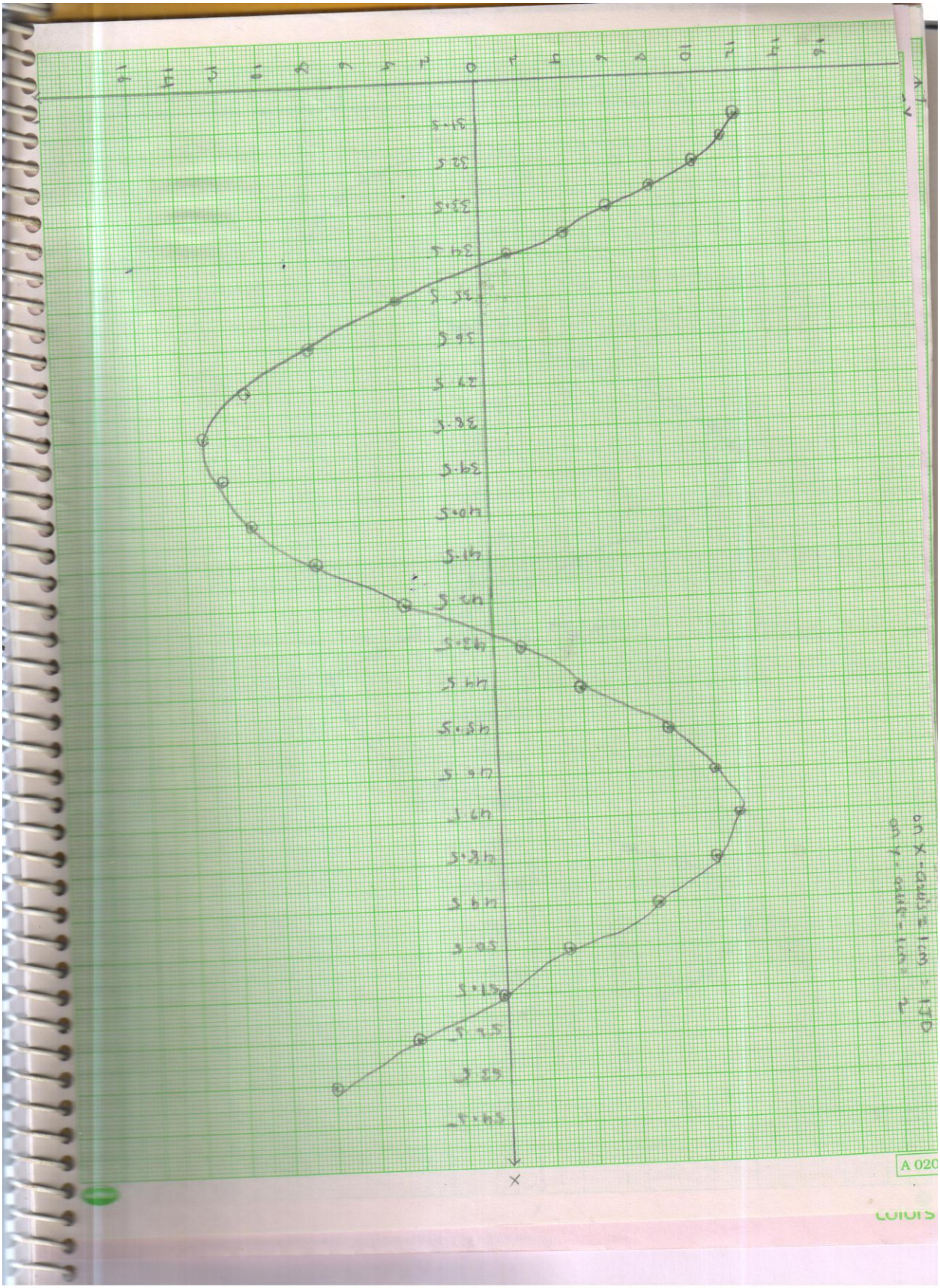

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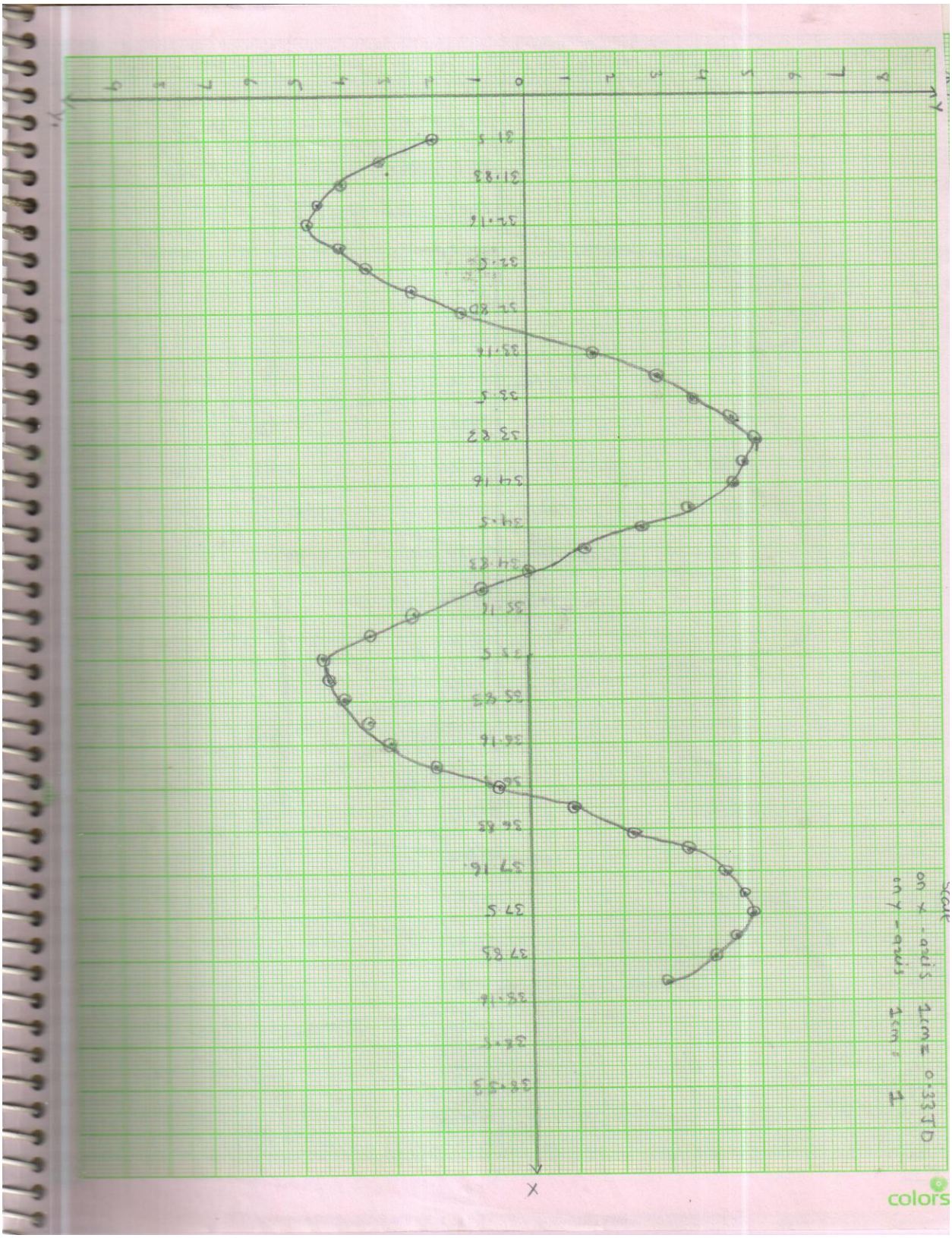

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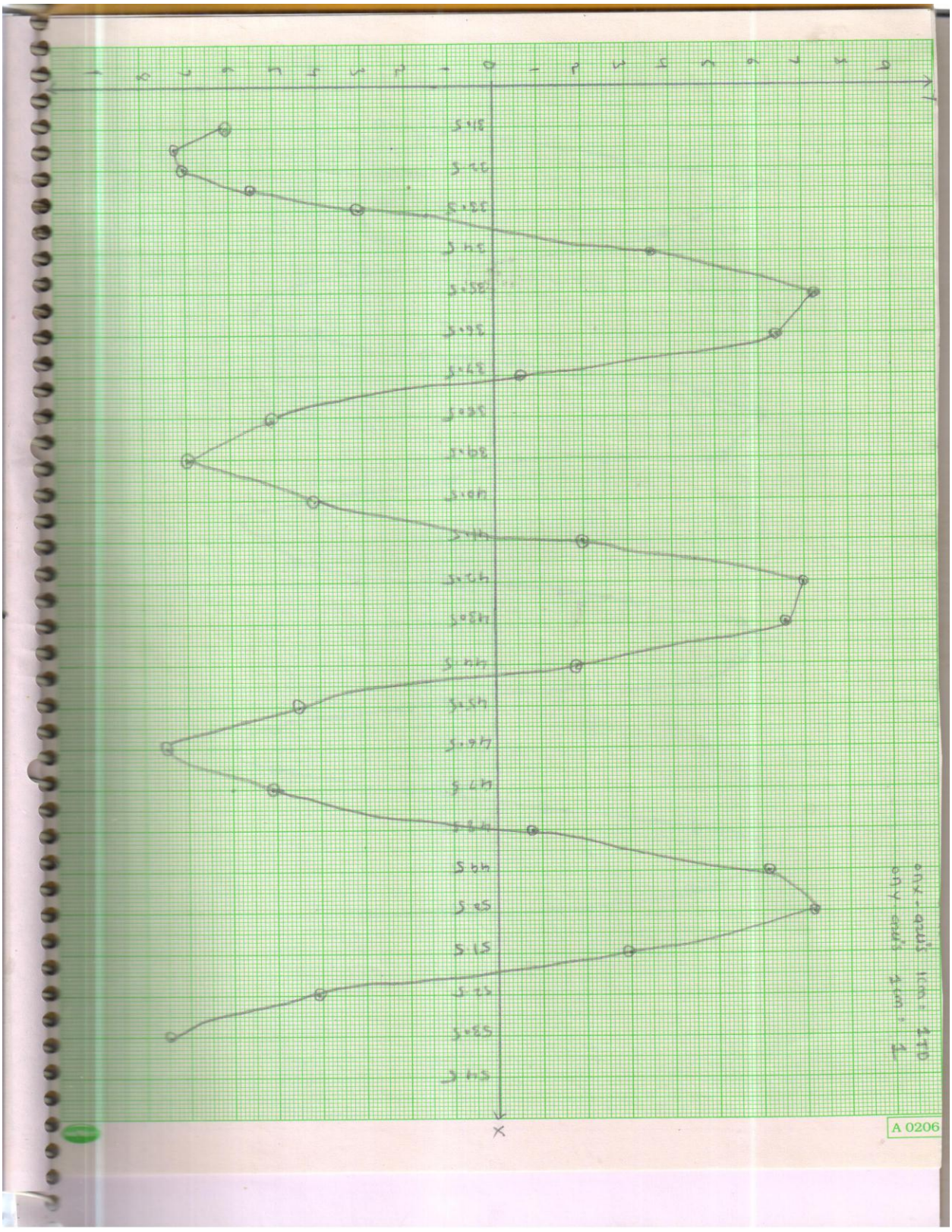

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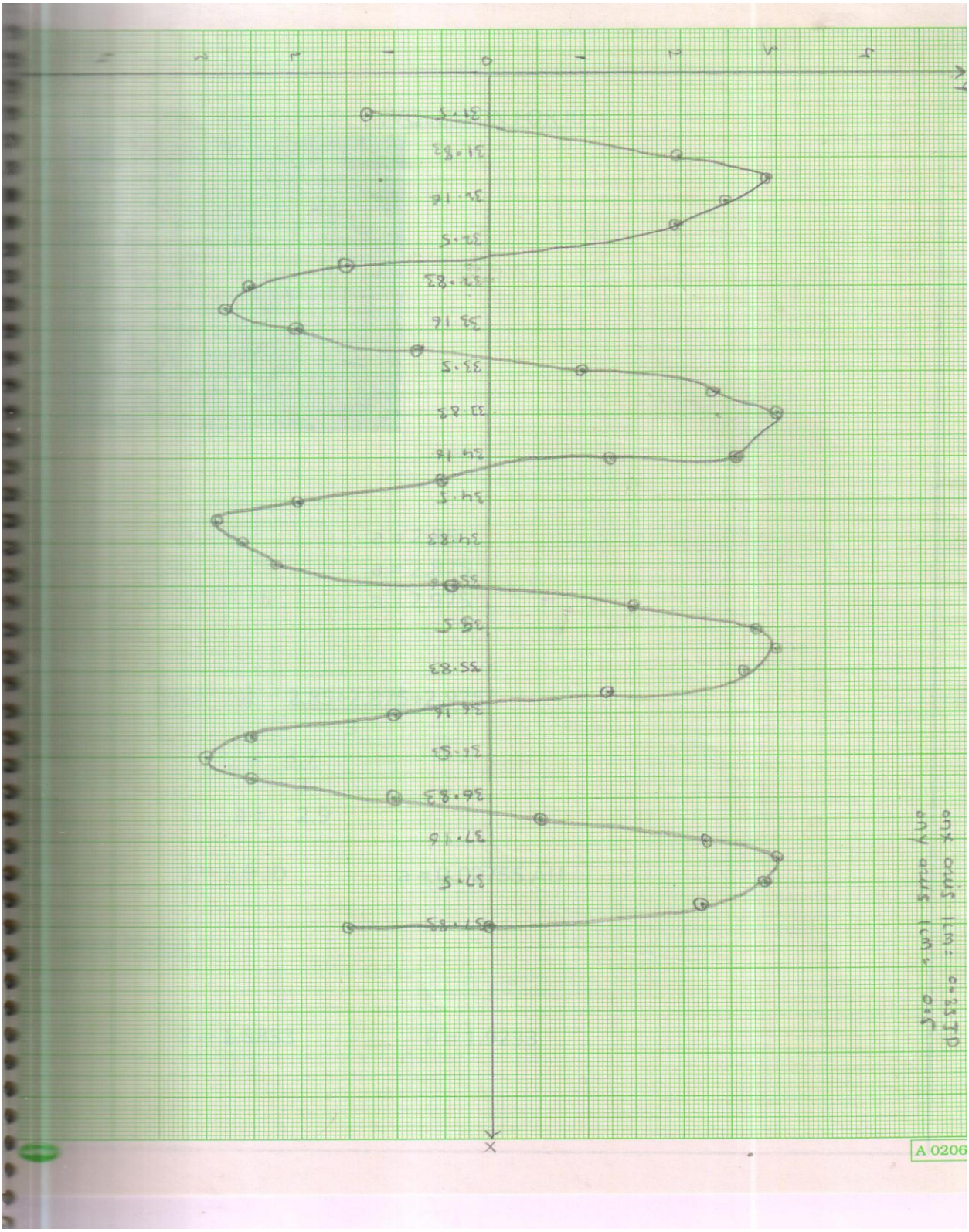

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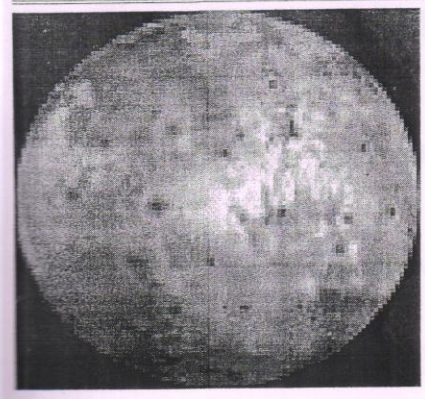
AMPLITUDE & PERIOD OF REVOLUTION FOR I0 :-



1) 2a = 5.7 a = 2.85
2) 2a = 5.75 a = 2.875
3) 2a = 5.95 a = 2.975

$$\text{Mean (a)} = \frac{2.85+2.875+2.975}{3}$$

$$= \frac{8.7}{3}$$

$$a = 2.9$$

a = 2.9 JD a = 0.02755 AU

>>>> FOR P :-

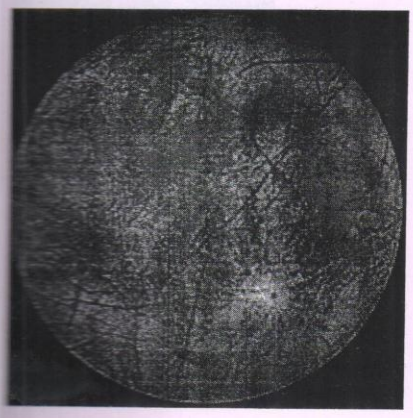
P = 1.5833 P = 1.9233

Mean (P) $= \frac{1.5833 + 1.9233}{2}$

P = 1.7533 days

P = 0.0048 year

AMPITUDE & PERIOD OF REVOLUTION FOR EUROPA :-



2a = 4.7 + 4.6

$= \frac{9.3}{2}$

a = 4.65 a= 0.0044175 AU

>>>> FOR P :-

P = 3.7667 DAYS

P = 0.01003 YEAR

AMPLITUDE & PERIOD OF GANYMEDE :-

1) 2a = 14.7 a = 7.35
2) 2a = 14.5 a = 7.25

$$\text{Mean (a)} = \frac{7.35+7.25}{2}$$

$$= \frac{14.6}{2}$$

$$= 7.3 \text{ JD}$$

a = 7.3 a= 0.00095 AU

>>>> FOR P :-

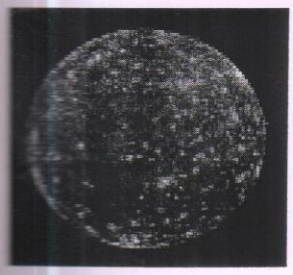
P = 7.25 P = 7

$$P = \frac{7.25 + 7}{2}$$

P = 7.125 DAYS

P = 0.01957 YEAR

AMPLITUDE & PERIOD FOR CALLISATO :-



a) 2a = 12.95 + 12.9

a = 12.925 JD

a = 0.01227 AU

>>>> FOR P:-

P = 16.85 DAYS = 0.04629 YEAR

SLOPE = $11.29 \times 10^2 \ M^{-1}$

MASS OF JUPITER = $\frac{1}{\text{Slope}}$

$= \frac{1}{11.29 \times 10^2}$

$= 0.088 \times 10^{-2} \ M$

$= 0.88 \times 10^{-3} \ M$

POSITION OF SATELITE	P^2	a^3
I_0	0.2304×10^{-4}	0.02091×10^{-8}
GANYMEDE	3.8298×10^{-4}	0.33613×10^{-8}
CALLISTO	21.4276×10^{-4}	1.8472×10^{-8}
EUROPA	1.0609×10^{-4}	0.08617×10^{-8}

SOLAR MASS = 1.9891×10^{33} Kg.

MASS OF JUPITER = $0.88 \times 10^{-3} \times 1.9891 \times 10^{33}$

MASS OF JUPITER = 1.75×10^{30} gm.

1) FOR INDIVIDUAL (I_0) :-

$$\frac{A^3}{P^2} = \frac{0.02091}{0.2304} \times 10^{-2}$$

$$= 0.090 \times 10^{-2} M$$

Mass of Jupiter = $(I_0) = 0.090 \times 10^{-2} \times 1.9891 \times 10^{33}$

$= 1.790 \times 10^{30}$ gm.

2) FOR GANYMEDE :-

$$\frac{A^3}{P^2} = \frac{0.3361}{3.829} \times 10^{-2}$$

$= 0.0877 \times 10^{-2} M$

Mass of Jupiter = $0.0877 \times 10^{-2} \times 1.9891 \times 10^{33}$

$= 1.744 \times 10^{30}$ gm.

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3) FOR CALLISTO :-

$$\frac{A^3}{P^2} = \frac{1.8472}{21.427} \times 10^{-2}$$

$$= 0.086 \times 10^{-2} \text{ M}$$

Mass of Jupiter = $0.086 \times 10^{-2} \times 1.989 \times 10^{33}$

$$= 1.7106 \times 10^{30} \text{ gm.}$$

4) FOR EUROPA :-

$$\frac{A^3}{P^2} = \frac{0.08617}{1.0609} \times 10^{-2}$$

$$= 0.081 \times 10^{-2} \text{ M}$$

Mass of Jupiter = $0.081 \times 10^{-2} \times 1.9891 \times 10^{33}$

$$= 1.61 \times 10^{30} \text{ gm.}$$

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OVERALL STUDY : -

This is the overall plan of action for this laboratory exercise.

Start up the program and use if to familiarise yourself with the Jupiter system.

Setup observing session.

Measure position of Jupiter moons are over successive clear nights.

Plot a graph of your observations for each moon. Using revolution of Jupiter moons program.

Using this program to help you fit a sine curve to each graph.

Determine the period and semi-major axis for the orbit of each moon from its graph then convert the value to years and AU respectively.

Calculate the mass of Jupiter from your Observation of each month then determine the average value for Jupiter Mars from your individual value.

PROCEDURE : -

DATA COLLECTION : -

If you have already logged in as described above stop the motion of the moons and select Run... again. The start date and time window will appear and now you will change the defaults, Each table will

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perform a different set of observing station to starting date of observation for each Labs as well as the Interval between observations will given to you by your instructor (A typically approach Is to observe at 12 hours Intervals unit you have successfully observed 18 times) fill in table then enter the information into the program. It is good Scientific practice to keep both paper and computer record when possible. Note that this time you will be replacing the defaults which are for the current date and time.

In order to measure the position of a moon move the pointer to the moon and left click the mouse the lower right hand corner of the screen will display the name of the moon. The X and Y co-ordinates of the position in pixel on your screen and its X co-ordinate expressed in dim. of Jupiter. The East or West of the planet center this is the crucial figure for all purpose. Note that if the name of the moon does not appear. you may not have clicked exactly on the moon so try again to measure each moon's position actually switch to the highest magnification that will keep the moon of the screen.

Column 1 : Date

Column 2 : Universal time

Column 3 : The number of day including cloudy days.

(e.g. -- 1.0,1.5,2.0...)

Column 4 : Record each month Position under the column for that moon be sure to not both distance and directions for example 2.75 W

You will also use the Computer to record your data for data analysis. After taking measurement select record measurements and enter the

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perform a different set of observing station to starting date of observation for each Labs as well as the Interval between observations will given to you by your instructor (A typically approach Is to observe at 12 hours Intervals unit you have successfully observed 18 times) fill in table then enter the information into the program. It is good Scientific practice to keep both paper and computer record when possible. Note that this time you will be replacing the defaults which are for the current date and time.

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(e.g. -- 1.0,1.5,2.0...)

Column 4 : Record each month Position under the column for that moon be sure to not both distance and directions for example 2.75 W

You will also use the Computer to record your data for data analysis. After taking measurement select record measurements and enter the

data in the dialogue box that appears you can go back and add or edit this data later using files > Data > Review.. but for the sake of covenience you may want to enter the data for all four moons before you go on to the next observing station to be scale use file > Data > save.... To save your data otherwise it will be lost. If the program closes. load under the same menu to retrive the saved files.

DATA ANALYSIS : -

You now need to analysis your data by plotting position velsus time you will use the data. To obtain a graph similar to the one below .The data shows are for an imaginary moon named CLEA. Note one of the Moon's in the laboratory exercise.

P = 14Days=0.038 3 years

a= 3 JD = 0.00 286 AU

CALCULATING JUPITER'S MASS :-

You now have all the information you need to use Kepler's third law. To find the mass of Jupiter. But not that values obtained from the graph have units of days for P and JD for a In order to use Kepler's third law you need to convert the period into years by dividing the number of days in a year (365) and the orbital radius Into A.U. by dividing by the

number of Jupiter diameter In an A.U. (1050). Enter your converted values in the Space provides in data table with P and a in the correct unit. Calculate mass of Jupiter's using data from each of the four moons if one of the values differs Significantly from the other three look for a source of either if no errors is found the data may not be adequate for a better result in which case you should leave the data as you found it.

$$M = \frac{a^3}{P^2}$$

Where,

M_j – the mass of Jupiter the solar mass.
a – radius of the orbit in A.U.
P – Is the period of the orbit

RESULT : -

1. FROM CALLISTO — $M_j = 1.7106 \times 10^{30}$ gm.
2. FROM GANYMEDE — $M_j = 1.744 \times 10^{30}$ gm.
3. FROM EUROPA — $M_j = 1.61 \times 10^{30}$ gm.
4. FROM I_0 — $M_j = 1.790 \times 10^{30}$ gm.

AVERAGE MASS OF JUPITER FORM THE GRAPH : -

$M_j = 1.75 \times 10^{30}$ gm.

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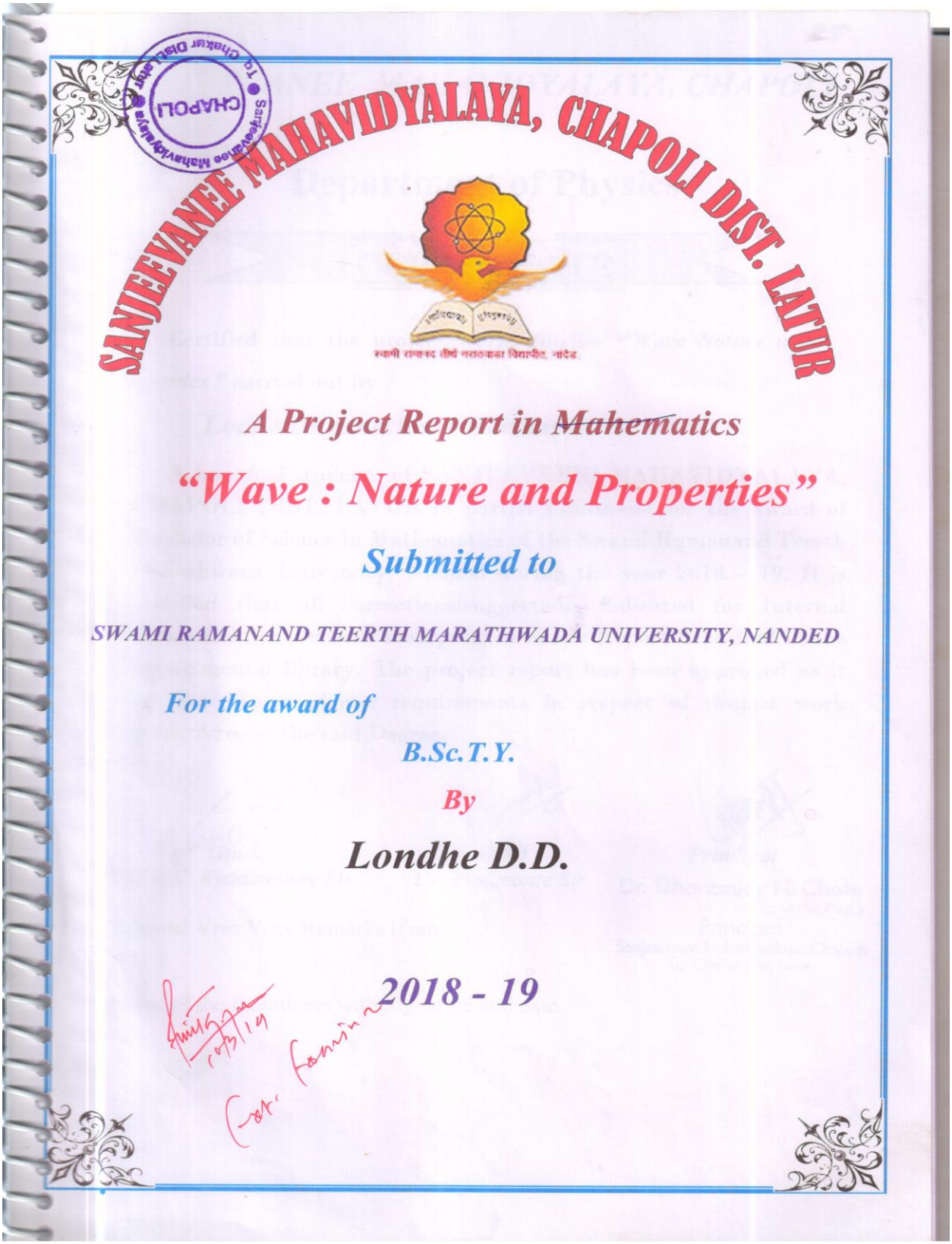

SANJEEVANEE MAHAVIDYALAYA, CHAPOLI DIST. LATUR

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

A Project Report in ~~Mahematics~~

"Wave : Nature and Properties"

Submitted to

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

For the award of

B.Sc.T.Y.

By

Londhe D.D.

2018 - 19

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SANJEEVANEE MAHAVIDYALAYA, CHAPOLI

Dist. Latur

Department of Physics

CERTIFICATE

Certified that the project work, entitled ***"Wave Nature and properties "*** carried out by

Lodhe Dnyaneshwar Devidas

A bonafied students of SANJEEVEENI MAHAVIDYALAYA, CHAPOLI DIST. LATUR in partial fulfillment for the award of Bachelor of Science in Mathematics of the Swami Ramanand Teerth Marathwada University, Nanded during the year 2018 – 19. It is certified that all corrections/suggestions indicated for Internal Assessments have been incorporated in the Report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the said Degree.

Guide	***HOD***	***Principal***
Prof. A.T. Kyadampure Sir	*Dr. Phulmante Sir*	Dr. Dhananjay N. Chate (M.Sc; M.Phil, Ph.d.) Principal Sanjeevanee Mahavidyalaya, Chapoli Tq. Chakur Dist. Latur

External Viva Voce Remarks if any.

Name of the Examiners with Signature and date

2.

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Swami RamanandTeerthMarathwada University, Nanded

Sanjeevanee Mahavidyalaya CHAPOLI Tq Chakur Dist.Latur

Year 2018-19

For the award of Degree

Bachelor of Science in

Physics

"THE ROLE OF BLACK HOLE IN ASTRONOMY "

Submitted by

Mr.Prasenjit Balaji Turewale

B.Sc.T.Y.

Guide

Mr.Dr.Fhulmante B.

Submitted To

Sanjeevanee Mahavidhalaya Chapoli

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Sanjeevanee Mahavidhalaya Chapoli

Certificate

This is to certify that *Mr.Prasenjit Balaji Turewale* student of B.Sc.T.Y. during the year 2018-19 has successfully completed the project **"THE ROLE OF BLACK HOLE IN ASTRONOMY "**under the supervision and guidance it is being awarded in the partial fulfilment of requirement for the Bachelor of Science (Physics) by S.R.T.M.U. Nanded.

Guide Examiner

Mr.Dr.Fhulmante B.

H.O.D

Mr.Dr.Fhulmante B.