SOME STUDIES ON MATHEMATICAL BIOLOGY

Project report submitted to Christ College (Autonomous) in partial fulfilment of requirement for the award of the B.Sc. Degree Programme in Mathematics

By

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2023

CERTIFICATE

This is to certify that the project entitled " **SOME STUDIES ON MATHEMATICAL BIOLOGY** " submitted to the Department of Mathematics in partial fulfilment of the requirement for the award of the B.Sc. Degree programme in Mathematics, is a bonafide record of original project work done by **NANDHANA C M (CCAUSMT012), ATHUL DEV P(CCAUSMT025), ANANYA MOHAN (CCATSMT021)** and **DEVIKA K VINOD (CCAUSMT028)** during the period of their study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda under my supervision and guidance during the year 2022-2023

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External Examiner:

Place: Irinjalakuda

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DECLARATION

We hereby declare that the project work entitled "**SOME STUDIES ON MATHEMATICAL BIOLOGY**" submitted to the Christ College (Autonomous) in partial fulfilment of the requirement for the award of the B.Sc. Degree programme in Mathematics is a record of original project work done by us during the period of our study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda.

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ACKNOWLEDGEMENT

We wish to acknowledge our indebtedness to a number of colleagues who made valuable efforts and suggestions to the content of this project. There are many individuals who have come together to make this project a reality. We greatly appreciate the inspiration, support and guidance of all those people who have been instrumental for making this project a success.

We express our deepest thanks to our guide Ms Tintumol Sunny, Assistant professor, Department of Mathematics, Christ College (Autonomous), Irinjalakuda, who guided us faithfully through this entire project. We have learned so much from her both in the subject and otherwise. Without her advice, support and guidance, it find difficult to complete this work.

We take this opportunity to express my thanks to our beloved principal Fr. Dr. Jolly Andrews CMI, who gave us the golden opportunity to do this wonderful project on the topic “SOME STUDIES ON MATHEMATICAL BIOLOGY ".

We mark our word of gratitude to Dr Seena V, HOD-in-Charge and all other teachers of the Department for providing the necessary facilities to complete this project on time. We Specially thank all the faculty in the library for providing various facilities for this project. Words cannot express the love and support we have received from our parents whose encouragement has buoyed us from the beginning till the end of this work.

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FIBONACCI SPIRAL AND THE NUMBERS

A project report submitted to Christ College (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree Programme in Mathematics

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This is to certify that the project entitled "**FIBONACCI SPIRAL AND THE NUMBERS**" submitted to the Department of Mathematics in partial fulfillment of the requirement for the award of the B.Sc. Degree programme in Mathematics, is a bonafide record of work carried out by **Ms. ROSE SIYA M G (CCAUSMT013)** during the period of her study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda under my supervision and guidance during the year 2022-2023.

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ACKNOWLEDGEMENT

Every project is successful largely due to the effort of a number of wonderful people who have always given their valuable advice or lent a helping hand. I sincerely appreciate the inspiration; support and guidance of all those people who have been instrumental in making this project a success, I would like to express my special thanks of gratitude to my guide Dr. Seena V., Assistant professor Department of Mathematics, Christ College Irinjalakuda who gave me the opportunity to do this project and helped me a lot. I take this opportunity to express my thanks to our beloved principal Rev. Dr. Jolly Andrews CMI, Christ College Irinjalakuda who gave me the golden opportunity to do this project on the topic "**FIBONACCI SPIRAL AND THE NUMBERS**", which also helped me in doing a lot of research and I came to know about so many things. I record my sincere thanks to Dr Seena V, HOD incharge of the Department of Mathematics and all other teachers of our department for providing me the necessary facilities to carry out the present work and for their strong support. I express my thanks to all the faculty of the library for providing various facilities for this project. Last but not least, I would like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project.

ROSE SIYA M G

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FRACTALS

A project report submitted to Christ College (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree Programme in Mathematics

by

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This is to certify that the project entitled "**FRACTALS**" submitted to the Department of Mathematics in partial fulfillment of the requirement for the award of the B.Sc. Degree programme in Mathematics, is a bonafide record of work carried out by **Ms. SREERA RAMESH (CCAUSMT016)** during the period of her study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda under my supervision and guidance during the year 2022-2023.

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ACKNOWLEDGEMENT

Every project is successful largely due to the effort of a number of wonderful people who have always given their valuable advise or lent a helping hand. I sincerely appreciate the inspiration; support and guidance of all those people who have been instrumental in making this project a success, I would like to express my special thanks of gratitude to my guide Ms. Gifty Thomas, Department of Mathematics, Christ College Irinjalakuda who gave me the opportunity to do this project in Microsoft Word and helping me a lot. I take this opportunity to express my thanks to our beloved principal Rev. Dr. Jolly Andrews CMI, Christ College Irinjalakuda who gave me the golden opportunity to do this project on the topic "**FRACTALS**", which also helped me in doing a lot of research and I came to know about so many things. I record my sincere thanks to Dr. Seena V, HOD in-charge of Mathematics and all other teachers of our department for providing me the necessary facilities to carry out the present work and for their strong support. I express our thanks to all the faculty of the library for providing various facilities for this project. Last but not least, I would like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project.

SREERA RAMESH

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CHAOS THEORY

A project report submitted to Christ College (Autonomous) in partial fulfilment of the requirement of the award of the B.sc Degree programme in Mathematics.

Submitted by

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I hereby declare that the project work entitled “Chaos theory” submitted to Christ College (Autonomous) in partial fulfilment of the requirement for the award of the B.Sc. Degree programme in Mathematics is a record of original project work done by me during the period of my study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda.

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ACKNOWLEDGEMENT

I am glad to gratefully acknowledge the efforts of several persons who helped me directly or indirectly to conduct this project work. Working on this project “CHAOS THEORY” was a source of immense knowledge to me. I owe a deep sense of gratitude to my project guide Naveen V V, Assistant Professor (Ad-hoc), Christ College (Autonomous), Irinjalakuda for his guidance and inspiration in completing this project. I also take this opportunity to express my sincere thanks to our beloved principal Fr.Dr. Jolly Andrews CMI, who gave me a chance to do this project.

The contributions of Dr. Seena V, Head of the department in charge and all other teachers of the department for providing me the necessary help to complete my project on time are duly acknowledged. I also extend my special thanks to all faculty of library for their valuable support to complete my project. I would also like to thank my dear parents for their love and support to complete my project. I also thank all my friends for their contribution.

The study has indeed helped me to explore more knowledgeable avenues related to my topic and I am sure it will help in my future.

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QUEUING THEORY

A project report submitted to Christ College (Autonomous) in partial fulfillment of requirement for the award of the B.Sc. Degree Programme in Mathematics

by

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ACKNOWLEDGEMENT

Firstly, there are no words to rightly acknowledge the wonderful grace the Almighty has given me. There are many individuals who have come together to make this project a reality. I greatly appreciate the inspiration; support and guidance of all those people who have been for making this project a success.

I would like to acknowledge the opportunity given by our beloved principal Rev. Fr. Dr. Jolly Andrews CMI, to do this project on the topic “Queuing Theory”.

I express my sincere gratitude to my guide Dr. Seena V, Assistant Professor, Department of Mathematics, Christ College (Autonomous), Irinjalakuda, who guided me through this project. Her help, encouragement and stimulating suggestions helped me in the completion of the project.

I would like to take this opportunity to thank all teachers of the department for providing me with necessary resources during the dcourse of the project.

I thankfully remember the faculty of the library for providing various facilities for the project.

Words cannot express the love and support I have received from my parents and classmates whose encouragement has buoyed me up from the beginning till the end of this work.

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INTRODUCTION TO GRACEFUL GRAPHS

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ACKNOWLEDGEMENT

Every project is successful largely due to the effort of a number of wonderful people who have always given their valuable advice or lent a helping hand. I sincerely appreciate the inspiration; support and guidance of all those people who have been instrumental in making this project a success, I would like to express my special thanks of gratitude to my guide Dr. Shinto K G, Assistant professor Department of Mathematics, Christ College Irinjalakuda who gave me the opportunity to do this project and helping me a lot. I take this opportunity to express my thanks to our beloved principal Rev. Dr. Jolly Andrews CMI, Christ College Irinjalakuda who gave me the golden opportunity to do this project on the topic **"INTRODUCTION TO GRACEFUL GRAPHS"**, which also helped me in doing a lot of research and I came to know about so many things. I record my sincere thanks to Dr Seena V, Head of the Department of Mathematics and all other teachers of our department for providing me the necessary facilities to carry out the present work and for their strong support. I express our thanks to all the faculty of the library for providing various facilities for this project. Last but not least, I would like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project.

AISWARYA RAJ K R

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QUEUING THEORY

A project report submitted to Christ College (Autonomous) in partial fulfillment of requirement for the award of the B.Sc. Degree Programme in Mathematics

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I hereby declare that the project work entitled "**QUEUING THEORY**" submitted to the Department of Mathematics in partial fulfillment of the requirement for the award of the B.Sc. Degree programme in Mathematics is a record of original project work done by, me during the period of my study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda.

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Firstly, there are no words to rightly acknowledge the wonderful grace the Almighty has given me. There are many individuals who have come together to make this project a reality. I greatly appreciate the inspiration; support and guidance of all those people who have been for making this project a success.

I would like to acknowledge the opportunity given by our beloved principal Rev. Fr. Dr. Jolly Andrews CMI, to do this project on the topic “Queuing Theory”.

I express my sincere gratitude to my guide Dr. Seena V, Assistant Professor, Department of Mathematics, Christ College (Autonomous), Irinjalakuda, who guided me through this project. Her help, encouragement and stimulating suggestions helped me in the completion of the project.

I would like to take this opportunity to thank all teachers of the department for providing me with necessary resources during the dcourse of the project.

I thankfully remember the faculty of the library for providing various facilities for the project.

Words cannot express the love and support I have received from my parents and classmates whose encouragement has buoyed me up from the beginning till the end of this work.

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INTRODUCTION……....(1)

1. PRELIMINARIES……..(3)

1.1. Poisson distribution……...(3)

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3. STOCHASTIC PROCESS AND LITTLE'S LAW……..……..(14)

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4. APPLICATIONS OF LITTLE'S LAW…….……(20)

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CONCLUSION…….……..(21)

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INTRODUCTION TO MODULE THEORY

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I hereby declare that the project work entitled "**INTRODUCTION TO MODULE THEORY**" submitted to Christ College (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree programme in Mathematics is a record of original project work done by ,me during the period of my study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda.

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ACKNOWLEDGEMENT

I am glad to gratefully acknowledge the efforts of several persons who helped me directly or indirectly to conduct this project work. Working on this project **"INTRODUCTION TO MODULE THOERY"** was a source of immense knowledge to me. I owe a deep sense of gratitude to my project guide Merin Mathew, Guest Professor, Christ College(Autonomous),Irinjalakuda for his guidance and inspiration in completing this project. I also take this opportunity to express my sincere thanks to our beloved principal Fr.Dr.Jolly Andrews CMI, who gave me a chance to do this project.

The contributions of Dr.Seena V, Head of the department in charge and all other teachers of the department for providing me the necessary help to complete my project on time are duly acknowledged. I also extend my special thanks to all faculty of library for their valuable support to complete my project. I would also like to thank my dear parents for their love and support to complete my project. I also thank all my friends for their contribution.

The study has indeed helped me to explore more knowledgeable avenues related to my topic and I am sure it will help in my future.

ANNLISHA E J

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QUEUING THEORY

A project report submitted to Christ College (Autonomous) in partial fulfillment of requirement for the award of the B.Sc. Degree Programme in Mathematics

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DECLARATION

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Date: 31 March 2023

ACKNOWLEDGEMENT

Firstly, there are no words to rightly acknowledge the wonderful grace the Almighty has given me. There are many individuals who have come together to make this project a reality. I greatly appreciate the inspiration; support and guidance of all those people who have been for making this project a success.

I would like to acknowledge the opportunity given by our beloved principal Rev. Fr. Dr. Jolly Andrews CMI, to do this project on the topic “Queuing Theory”.

I express my sincere gratitude to my guide Dr. Seena V, Assistant Professor, Department of Mathematics, Christ College (Autonomous), Irinjalakuda, who guided me through this project. Her help, encouragement and stimulating suggestions helped me in the completion of the project.

I would like to take this opportunity to thank all teachers of the department for providing me with necessary resources during the dcourse of the project.

I thankfully remember the faculty of the library for providing various facilities for the project.

Words cannot express the love and support I have received from my parents and classmates whose encouragement has buoyed me up from the beginning till the end of this work.

ARUN T M

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1. PRELIMINARIES……..(3)

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3.1. Definition of stochastic process……..……(14)

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A STUDY ON FUZZY SET

A project report submitted to Christ College (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree Programme in Mathematics

by

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CERTIFICATE

This is to certify that the project entitled "**A STUDY ON FUZZY SETS**" submitted to the Department of Mathematics in partial fulfillment of the requirement for the award of the B.Sc. Degree programme in Mathematics, is a bonafide record of work carried out by **Ms. CERINE MARIA (CCAUSMT026)** during the period of her study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda under my supervision and guidance during the year 2022-2023.

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Date : 31 March 2023

ACKNOWLEDGEMENT

Every project is successful largely due to the effort of a number of wonderful people who have always given their valuable advice or lent a helping hand. I sincerely appreciate the inspiration; support and guidance of all those people who have been instrumental in making this project a success, I would like to express my special thanks of gratitude to my guide Dr. Fr. Vincent N. S. CMI, Assistant professor Department of Mathematics, Christ College Irinjalakuda who gave me the opportunity to do this project and helped me a lot. I take this opportunity to express my thanks to our beloved principal Rev. Dr. Jolly Andrews CMI, Christ College Irinjalakuda who gave me the golden opportunity to do this project on the topic **"A STUDY ON FUZZY SETS"**, which also helped me in doing a lot of research and I came to know about so many things. I record my sincere thanks to Dr Seena V, HOD in-charge of the Department of Mathematics and all other teachers of our department for providing me the necessary facilities to carry out the present work and for their strong support. I express my thanks to all the faculty of the library for providing various facilities for this project. Last but not least, I would like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project.

CERINE MARIA

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FIBONACCI SPIRAL AND THE NUMBERS

A project report submitted to Christ College (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree Programme in Mathematics

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ACKNOWLEDGEMENT

Every project is successful largely due to the effort of a number of wonderful people who have always given their valuable advice or lent a helping hand. I sincerely appreciate the inspiration; support and guidance of all those people who have been instrumental in making this project a success, I would like to express my special thanks of gratitude to my guide Dr. Seena V., Assistant professor Department of Mathematics, Christ College Irinjalakuda who gave me the opportunity to do this project and helped me a lot. I take this opportunity to express my thanks to our beloved principal Rev. Dr. Jolly Andrews CMI, Christ College Irinjalakuda who gave me the golden opportunity to do this project on the topic "**FIBONACCI SPIRAL AND THE NUMBERS**", which also helped me in doing a lot of research and I came to know about so many things. I record my sincere thanks to Dr Seena V, HOD incharge of the Department of Mathematics and all other teachers of our department for providing me the necessary facilities to carry out the present work and for their strong support. I express my thanks to all the faculty of the library for providing various facilities for this project. Last but not least, I would like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project.

DELNA THOMAS

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POSITIVE DEFINITE MATRICES

A project report submitted to Christ College (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree Programme in Mathematics

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CHAOS THEORY

A project report submitted to Christ College (Autonomous) in partial fulfilment of the requirement of the award of the B.sc Degree programme in Mathematics.

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I hereby declare that the project work entitled "Chaos theory" submitted to Christ College (Autonomous) in partial fulfilment of the requirement for the award of the B.Sc. Degree programme in Mathematics is a record of original project work done by me during the period of my study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda.

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ACKNOWLEDGEMENT

I am glad to gratefully acknowledge the efforts of several persons who helped me directly or indirectly to conduct this project work. Working on this project “CHAOS THEORY” was a source of immense knowledge to me. I owe a deep sense of gratitude to my project guide Naveen V V, Assistant Professor (Ad-hoc), Christ College (Autonomous), Irinjalakuda for his guidance and inspiration in completing this project. I also take this opportunity to express my sincere thanks to our beloved principal Fr.Dr. Jolly Andrews CMI, who gave me a chance to do this project.

The contributions of Dr. Seena V, Head of the department in charge and all other teachers of the department for providing me the necessary help to complete my project on time are duly acknowledged. I also extend my special thanks to all faculty of library for their valuable support to complete my project. I would also like to thank my dear parents for their love and support to complete my project. I also thank all my friends for their contribution.

The study has indeed helped me to explore more knowledgeable avenues related to my topic and I am sure it will help in my future.

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INTRODUCTION TO GRACEFUL GRAPHS

A project report submitted to Christ College (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree Programme in Mathematics

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ACKNOWLEDGEMENT

Every project is successful largely due to the effort of a number of wonderful people who have always given their valuable advice or lent a helping hand. I sincerely appreciate the inspiration; support and guidance of all those people who have been instrumental in making this project a success, I would like to express my special thanks of gratitude to my guide Dr. Shinto K G, Assistant professor Department of Mathematics, Christ College Irinjalakuda who gave me the opportunity to do this project and helping me a lot. I take this opportunity to express my thanks to our beloved principal Rev. Dr. Jolly Andrews CMI, Christ College Irinjalakuda who gave me the golden opportunity to do this project on the topic **"INTRODUCTION TO GRACEFUL GRAPHS"**, which also helped me in doing a lot of research and I came to know about so many things. I record my sincere thanks to Dr Seena V, Head of the Department of Mathematics and all other teachers of our department for providing me the necessary facilities to carry out the present work and for their strong support. I express our thanks to all the faculty of the library for providing various facilities for this project. Last but not least, I would like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project.

RAMSHEELA P B

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A STUDY ON FUZZY SET

A project report submitted to Christ College (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree Programme in Mathematics

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ACKNOWLEDGEMENT

Every project is successful largely due to the effort of a number of wonderful people who have always given their valuable advice or lent a helping hand. I sincerely appreciate the inspiration; support and guidance of all those people who have been instrumental in making this project a success, I would like to express my special thanks of gratitude to my guide Dr. Fr. Vincent N. S. CMI, Assistant professor Department of Mathematics, Christ College Irinjalakuda who gave me the opportunity to do this project and helped me a lot. I take this opportunity to express my thanks to our beloved principal Rev. Dr. Jolly Andrews CMI, Christ College Irinjalakuda who gave me the golden opportunity to do this project on the topic **"A STUDY ON FUZZY SETS"**, which also helped me in doing a lot of research and I came to know about so many things. I record my sincere thanks to Dr Seena V, HOD in-charge of the Department of Mathematics and all other teachers of our department for providing me the necessary facilities to carry out the present work and for their strong support. I express our thanks to all the faculty of the library for providing various facilities for this project. Last but not least, I would like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project.

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ACKNOWLEDGEMENT

Every project is successful largely due to the effort of a number of wonderful people who have always given their valuable advice or lent a helping hand. I sincerely appreciate the inspiration; support and guidance of all those people who have been instrumental in making this project a success, I would like to express my special thanks of gratitude to my guide Dr. Seena V., Assistant professor Department of Mathematics, Christ College Irinjalakuda who gave me the opportunity to do this project and helped me a lot. I take this opportunity to express my thanks to our beloved principal Rev. Dr. Jolly Andrews CMI, Christ College Irinjalakuda who gave me the golden opportunity to do this project on the topic "**FIBONACCI SPIRAL AND THE NUMBERS**", which also helped me in doing a lot of research and I came to know about so many things. I record my sincere thanks to Dr Seena V, HOD incharge of the Department of Mathematics and all other teachers of our department for providing me the necessary facilities to carry out the present work and for their strong support. I express my thanks to all the faculty of the library for providing various facilities for this project. Last but not least, I would like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project.

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INTRODUCTION TO GRACEFUL GRAPHS

A project report submitted to Christ College (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree Programme in Mathematics

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ACKNOWLEDGEMENT

Every project is successful largely due to the effort of a number of wonderful people who have always given their valuable advice or lent a helping hand. I sincerely appreciate the inspiration; support and guidance of all those people who have been instrumental in making this project a success, I would like to express my special thanks of gratitude to my guide Dr. Shinto K G, Assistant professor Department of Mathematics, Christ College Irinjalakuda who gave me the opportunity to do this project and helping me a lot. I take this opportunity to express my thanks to our beloved principal Rev. Dr. Jolly Andrews CMI, Christ College Irinjalakuda who gave me the golden opportunity to do this project on the topic **"INTRODUCTION TO GRACEFUL GRAPHS"**, which also helped me in doing a lot of research and I came to know about so many things. I record my sincere thanks to Dr Seena V, Head of the Department of Mathematics and all other teachers of our department for providing me the necessary facilities to carry out the present work and for their strong support. I express our thanks to all the faculty of the library for providing various facilities for this project. Last but not least, I would like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project.

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INTRODUCTION TO MODULE THEORY

A project report submitted to Christ College (Autonomous) in partial fulfillment of requirement for the award of the B.Sc. Degree Programme in Mathematics

By

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Date: 18 April 2023

ACKNOWLEDGEMENT

I am glad to gratefully acknowledge the efforts of several persons who helped me directly or indirectly to conduct this project work. Working on this project **"INTRODUCTION TO MODULE THOERY"** was a source of immense knowledge to me. I owe a deep sense of gratitude to my project guide Merin Mathew, Guest Professor, Christ College(Autonomous),Irinjalakuda for his guidance and inspiration in completing this project. I also take this opportunity to express my sincere thanks to our beloved principal Fr.Dr.Jolly Andrews CMI, who gave me a chance to do this project.

The contributions of Dr.Seena V, Head of the department in charge and all other teachers of the department for providing me the necessary help to complete my project on time are duly acknowledged. I also extend my special thanks to all faculty of library for their valuable support to complete my project. I would also like to thank my dear parents for their love and support to complete my project. I also thank all my friends for their contribution.

The study has indeed helped me to explore more knowledgeable avenues related to my topic and I am sure it will help in my future.

AMAL KRISHNA M U

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QUEUING THEORY

A project report submitted to Christ College (Autonomous) in partial fulfillment of requirement for the award of the B.Sc. Degree Programme in Mathematics

by

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2023

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This is to certify that the project entitled "**QUEUING THEORY**" submitted to the Department of Mathematics in partial fulfillment of the requirement for the award of the B.Sc. Degree programme in Mathematics, is a bonafide record of original research work done by Ms. **DEVI KISHORE (CCAUSMT042)**, during the period of her study in the Department of Mathematics, ChristCollege (Autonomous), Irinjalakuda under my supervision and guidance during the year 2020-2023.

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DECLARATION

I hereby declare that the project work entitled "**QUEUING THEORY**" submitted to the Department of Mathematics in partial fulfillment of the requirement for the award of the B.Sc. Degree programme in Mathematics is a record of original project work done by, me during the period of my study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda.

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Date: 31 March 2023

ACKNOWLEDGEMENT

Firstly, there are no words to rightly acknowledge the wonderful grace the Almighty has given me. There are many individuals who have come together to make this project a reality. I greatly appreciate the inspiration; support and guidance of all those people who have been for making this project a success.

I would like to acknowledge the opportunity given by our beloved principal Rev. Fr. Dr. Jolly Andrews CMI, to do this project on the topic “Queuing Theory”.

I express my sincere gratitude to my guide Dr. Seena V, Assistant Professor, Department of Mathematics, Christ College (Autonomous), Irinjalakuda, who guided me through this project. Her help, encouragement and stimulating suggestions helped me in the completion of the project.

I would like to take this opportunity to thank all teachers of the department for providing me with necessary resources during the dcourse of the project.

I thankfully remember the faculty of the library for providing various facilities for the project.

Words cannot express the love and support I have received from my parents and classmates whose encouragement has buoyed me up from the beginning till the end of this work.

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INTRODUCTION TO GRACEFUL GRAPHS

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ACKNOWLEDGEMENT

Every project is successful largely due to the effort of a number of wonderful people who have always given their valuable advice or lent a helping hand. I sincerely appreciate the inspiration; support and guidance of all those people who have been instrumental in making this project a success, I would like to express my special thanks of gratitude to my guide Dr. Shinto K G, Assistant professor Department of Mathematics, Christ College Irinjalakuda who gave me the opportunity to do this project and helping me a lot. I take this opportunity to express my thanks to our beloved principal Rev. Dr. Jolly Andrews CMI, Christ College Irinjalakuda who gave me the golden opportunity to do this project on the topic **"INTRODUCTION TO GRACEFUL GRAPHS"**, which also helped me in doing a lot of research and I came to know about so many things. I record my sincere thanks to Dr Seena V, Head of the Department of Mathematics and all other teachers of our department for providing me the necessary facilities to carry out the present work and for their strong support. I express our thanks to all the faculty of the library for providing various facilities for this project. Last but not least, I would like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project.

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QUEUING THEORY

A project report submitted to Christ College (Autonomous) in partial fulfillment of requirement for the award of the B.Sc. Degree Programme in Mathematics

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ACKNOWLEDGEMENT

Firstly, there are no words to rightly acknowledge the wonderful grace the Almighty has given me. There are many individuals who have come together to make this project a reality. I greatly appreciate the inspiration; support and guidance of all those people who have been for making this project a success.

I would like to acknowledge the opportunity given by our beloved principal Rev. Fr. Dr. Jolly Andrews CMI, to do this project on the topic “Queuing Theory”.

I express my sincere gratitude to my guide Dr. Seena V, Assistant Professor, Department of Mathematics, Christ College (Autonomous), Irinjalakuda, who guided me through this project. Her help, encouragement and stimulating suggestions helped me in the completion of the project.

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Words cannot express the love and support I have received from my parents and classmates whose encouragement has buoyed me up from the beginning till the end of this work.

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A STUDY ON FUZZY SET

A project report submitted to Christ College (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree Programme in Mathematics

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I hereby declare that the project work entitled **"A STUDY ON FUZZY SETS"** submitted to the Christ College Irinjalakuda (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree programme in Mathematics is a bonafide work done by me during the period of my study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda.

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ACKNOWLEDGEMENT

Every project is successful largely due to the effort of a number of wonderful people who have always given their valuable advice or lent a helping hand. I sincerely appreciate the inspiration; support and guidance of all those people who have been instrumental in making this project a success, I would like to express my special thanks of gratitude to my guide Dr. Fr. Vincent N. S. CMI, Assistant professor Department of Mathematics, Christ College Irinjalakuda who gave me the opportunity to do this project and helped me a lot. I take this opportunity to express my thanks to our beloved principal Rev. Dr. Jolly Andrews CMI, Christ College Irinjalakuda who gave me the golden opportunity to do this project on the topic **"A STUDY ON FUZZY SETS"**, which also helped me in doing a lot of research and I came to know about so many things. I record my sincere thanks to Dr Seena V, HOD in-charge of the Department of Mathematics and all other teachers of our department for providing me the necessary facilities to carry out the present work and for their strong support. I express my thanks to all the faculty of the library for providing various facilities for this project. Last but not least, I would like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project.

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INTRODUCTION TO GRACEFUL GRAPHS

A project report submitted to Christ College (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree Programme in Mathematics

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CERTIFICATE

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DECLARATION

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ACKNOWLEDGEMENT

Every project is successful largely due to the effort of a number of wonderful people who have always given their valuable advice or lent a helping hand. I sincerely appreciate the inspiration; support and guidance of all those people who have been instrumental in making this project a success, I would like to express my special thanks of gratitude to my guide Dr. Shinto K G, Assistant professor Department of Mathematics, Christ College Irinjalakuda who gave me the opportunity to do this project and helping me a lot. I take this opportunity to express my thanks to our beloved principal Rev. Dr. Jolly Andrews CMI, Christ College Irinjalakuda who gave me the golden opportunity to do this project on the topic **"INTRODUCTION TO GRACEFUL GRAPHS"**, which also helped me in doing a lot of research and I came to know about so many things. I record my sincere thanks to Dr Seena V, Head of the Department of Mathematics and all other teachers of our department for providing me the necessary facilities to carry out the present work and for their strong support. I express our thanks to all the faculty of the library for providing various facilities for this project. Last but not least, I would like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project.

GOKUL RAJAN

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POSITIVE DEFINITE MATRICES

A project report submitted to Christ College (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree Programme in Mathematics

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This is to certify that the project entitled **"POSITIVE DEFINITE MATRICES"** submitted to the Department of Mathematics in partial fulfillment of the requirement for the award of the B.Sc. Degree programme in Mathematics, is a bonafide record of work carried out by **Ms. MEERA A S (CCAUSMT009)** during the period of her study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda under my supervision and guidance during the year 2022-2023.

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DECLARATION

I hereby declare that the project work entitled "**POSITIVE DEFINITE MATRICES**" submitted to Christ College (Autonomous), Irinjalakuda in partial fulfillment of the requirement for the award of the B.Sc. Degree programme in Mathematics is a bonafide work done by me during the period of my study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda.

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INTRODUCTION TO MODULE THEORY

A project report submitted to Christ College (Autonomous) in partial fulfillment of requirement for the award of the B.Sc. Degree Programme in Mathematics

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This is to certify that the project entitled "**INTRODUCTION TO MODULE THEORY**" submitted to the Department of Mathematics in partial fulfillment of the requirement for the award of the B.Sc. Degree programme in Mathematics, is a bonafide record of original research work done by Ms .NAMITHA NANDAN **(CCAUSMT011)**, during the period of his study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda under my supervision and guidance during the year 2022-2023.

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DECLARATION

I hereby declare that the project work entitled "**INTRODUCTION TO MODULE THEORY**" submitted to Christ College (Autonomous) in partial fulfillment of the requirement for the award of the B.Sc. Degree programme in Mathematics is a record of original project work done by ,me during the period of my study in the Department of Mathematics, Christ College (Autonomous), Irinjalakuda.

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The contributions of Dr.Seena V, Head of the department in charge and all other teachers of the department for providing me the necessary help to complete my project on time are duly acknowledged. I also extend my special thanks to all faculty of library for their valuable support to complete my project. I would also like to thank my dear parents for their love and support to complete my project. I also thank all my friends for their contribution.

The study has indeed helped me to explore more knowledgeable avenues related to my topic and I am sure it will help in my future.

NAMITHA NANDAN

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