PRIYADARSHINI GOVERNMENT DEGREE COLLEGE (W)

GADWAL – 509125

Accredited with "C" Grade,

Affiliated to Palamuru University

Jogulamba Gadwal Dist., Telangana

DEPARTMENT OF MATHEMATICS

JIGNASA – STUDENT STUDY PROJECT – 2023-24

On

"THE APPLICATIONS OF MATHEMATICS IN HEALTH CARE MEDICINE"

SUBMITTED BY:

1. **E. ARUNA JYOTHI** — **III B.Sc(MPCs)**
2. **G .BHAVANI** — **III B.Sc(MPCs)**
3. **M .MANASA** — **III B.Sc(MPCs)**
4. **B. PAVANI** — **III B.Sc(MPCs)**
5. **B. AKHILA** — **II B.Sc(MPCs)**

Under the Supervision of

Sri.B.Jagan Mohan., **M.Sc B.Ed**

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PRINCIPAL

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DEPARTMENT OF MATHEMATICS

Academic year : 2023-2024

JIGNASA STUDENT STUDY PROJECT-

ON

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JIGNASA STUDENT STUDY PROJECT submitted to the

Commissioner of Collegiate Education, Hyderabad.

SUBMITTED BY:

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Declaration

We do hereby declare that the work presented in this study project is an original one and has been carried out by us in the Department of Mathematics, Government Degree College, for women Gadwal, and Jogulamba Dist. and has not been submitted either in part or in full for the award of any Degree or Diploma of any University earlier.

Place : Gadwal.

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Signature of the principal

Signature of the Supervisor

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CERTIFICATE

This is to certify that the thesis entitled

THE APPLICATIONS OF MATHEMATICS IN HEALTH CARE MEDICINES

Jignasa Student Study Project is submitted by , BSc Physical Science Students of this Institute , Department of Mathematics, is a bonafide record of the project work carried out under my supervision and guidance. It is further certified that no part of this project work is submitted for the award of any degree.

B JAGAN MOHAN

Lecturer in Mathematics

PGDC (W) GADWAL.

ACKNOWLEDGEMENT

In pursuit of this academic endeavor we feel that we have been especially fortunate as inspiration, guidance, direction, co-operation, love and care all came in our way in abundance and it seems almost an impossible task for us to acknowledge the same in adequate terms.

We express our sincere thanks to our supervisor, B. Jagan Mohan, lect in Mathematics, Department of Mathematics, Priyadarshini GDC(W) Gadwal , for his esteemed supervision, incessant support, inspiration and constructive criticism throughout our Jignasa Student Study Project work.

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1. E Aruna Jyothi, 2. G Bavani, 3. M .Manasa 4.B Pavani 5.B Akhila,

BSC PHYSICAL SCIENCE

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GADWAL

TABLE OF CONTENT

Statement of the Problem:

Knowingly or unknowing people have been making use of mathematics in all their fields. It is wrongly conceived by same in the simply a society that mathematics is simply a subject of problems and equations.

How were Mathematical concepts is useful in medicine field ?

Doctors and nurse use math when they write prescriptions or administer medication. Medical professional use drawing up statistical graphs of epidemics or success rates of treatments .Math applies to x-rays and CAT scans .Numbers provide an abundance of information for medical professionals in addition to calculus I and II ,there are many higher level math classes that are useful in the study of medicine.

Aims and Objectives:

The jignasa students study project is lovingly accepted and done with certain aims and objectives .They are

- To enlighten the people about the application of mathematics in the sector of medical health care.
- To classify and explore the use of mathematical measurements in the prescription of the use of liquid medicines.
- To lighten the various aspects of mathematics where it is being applied especially in medical health care industry.
- To provide information about the unlimited contribution of mathematics in there shapes of pills and potions along with the curve lines in CT scans and ECG's and their pros and cons in applications and adaptability.

Review of Literature:

(1) Most of our project work is based on the study at " Government hospital".

(2) Study is also extended too observing and analyzing the Mathematical application in medicine through the Internet.

Research Methodology: Observational method, experimental method, analytical method, .

Analysis of Data: We visited so many times the hospitals which is located near by our college and took photographs and analyzed them by using mathematical concepts which are known to us,they are looking mathematical concepts but we needed perceptiveness and references to understand them.

Findings:

Calculating medical drug dosage

When you go to the doctor, they talk to you in numbers. Your blood pressure, temperature, pulse, and your weight are all measured numerically. Medical professionals use math when drawing up statistical graphs to show success rates of treatments and other large data points. All graphs, equations, statistics, and general maths we learn at school help us understand important aspects of human and veterinary medicine, biology, and science.

Pharmacology uses the metric system,so most dosage interactions refer to milligrams per kilogram of body weight. Which requires knowledge of Ratios or fractions ,Multiplications and Division , Healthcare professionals use basic arthritics every day,and simple geometry ,per-algebra , probability

Example 1:

The doctor orders 90 milligrams of liquid cough syrup. The liquid cough syrup has a label that reads 120 milligrams in 5 milliliters How much cough syrup should the nurse give to the patient ? solving

Formula:

$$X = \frac{D}{H} \times Q$$

D= Dosage ordered : 90 mg

H = Dosage strength : 120 mg

Q = Quantity of units : 5 ml

X = Unknown dosage

$$X = \frac{90mg}{120mg} \times 5ml$$

$$X = \frac{3}{4} \times 5ml$$

$$X = \frac{15}{4} = 3.75 \text{ ml}$$

Therefore, the nurse should give 3.75 ml of the cough syrup to the patient.

MATHS in X - Rays:

Mathematics plays a crucial role in various aspects X-ray technology including image Formation analysis and interpretation ,here are some key mathematical concepts and techniques used in X - ray images. The following mathematics key role in x- ray

1) Algebra and Geometry
2) Calculus
3) Statistics
4) Linear Algebra
5) Numerical Methods

Algebra and geometry :

Basic algebraic equations and geometric principles are fundamental in understanding X-ray interactions with matter and the geometry of X-ray imaging systems. Equations derived from algebraic and geometric principles help in calculating X-ray attenuation, geometric magnification, and field of view.

Calculus :Calculus is used to model and analyze the behavior of X-ray photons as they interact with matter. Differential calculus is applied to describe the rate of change of X-ray intensity as it passes through a material, while integral calculus is used in the formulation of the Beer-Lambert law for X-ray attenuation.

Statistics:

Statistical methods are utilized in X-ray imaging for tasks such as image reconstruction, noise reduction, and quantitative analysis. Statistical models are applied to characterize noise in X-ray images, estimate uncertainty in measurements, and improve the quality of reconstructed images.

. Linear Algebra:

Linear algebra plays a crucial role in X-ray imaging algorithms, particularly in computed tomography (CT) reconstruction. Matrices and linear transformations are used to represent X-ray projection data and to formulate reconstruction algorithms such as filtered back projection and iterative methods.

. Signal Processing :

X-ray images are processed using signal processing techniques to enhance image quality and extract relevant information. Fourier analysis, wavelet transforms, and filtering methods are applied to X-ray data for tasks such as noise reduction, edge detection, and feature extraction.

Numerical Methods:

Numerical methods are used to solve mathematical equations and perform calculations in X-ray imaging. Finite difference methods, finite element methods, and Monte Carlo simulations are applied to model X-ray interactions, simulate imaging processes, and optimize imaging parameters.

These are few examples of the diverse mathematical techniques applied in X-ray technology. Mathematics serves as the foundation for understanding, designing, and optimizing X-ray imaging systems and plays a crucial role in advancing the field for various applications in medicine, industry, and research.

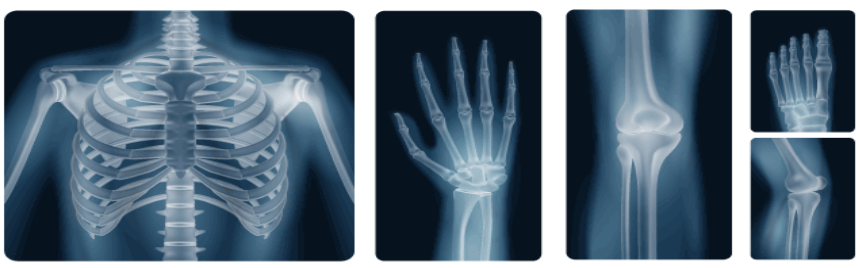
Projection Equations

X-ray projection data can be represented mathematically using line integrals. The projection of an X-ray attenuation function f (x,y) along a line L with orientation θ
Can be expressed as

$$P\theta(S) = \int_{-\infty}^{\infty} f(x,y)\, dx$$

Where

- $P\theta(S)$ is the ray projection at angle θ and distance S from x -ray source
- f (x,y) is the attenuation function representing the X-ray absorption properties of the object
- The integral is taken along the line L defined by $x \cos\theta + y \sin\theta = S$



MATHS IN ECG AND C T SCANNING :

In both CT (Computed Tomography) scanning and ECG (Electrocardiography), mathematics plays a crucial role in various aspects of signal processing, image reconstruction, analysis, and interpretation. Here's how mathematics is applied in each

Mathematics in CT Scanning:

Radon Transform:

The mathematical principle underlying CT scanning is the Radon transform, which mathematically describes how X-ray projections from different angles can be used to reconstruct cross-sectional images of the body. The Radon transform is used to convert raw projection data acquired from multiple angles into a 2D or 3D image of the internal structures.

Filtered Back Projection (FBP):

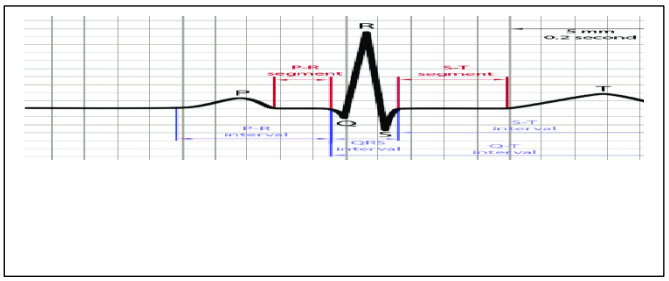
FBP is a commonly used algorithm for image reconstruction in CT scanning. It involves applying Fourier transforms to the X-ray projection data, followed by filtering in the frequency domain and back projecting the filtered data to reconstruct the image. Mathematical principles of Fourier analysis and convolution are essential for FBP reconstruction.

Iterative Reconstruction:

Iterative reconstruction methods in CT scanning use mathematical optimization techniques to iteratively refine an initial estimate of the image until it matches the acquired projection data. These methods often involve solving systems of linear equations, using techniques such as algebraic reconstruction algorithms (ART) or simultaneous iterative reconstruction techniques (SIRT)

Mathematics in ECG (Electrocardiography):

Signal Processing:



ECG signals are processed using mathematical techniques such as filtering, baseline correction, and noise reduction to enhance signal quality and extract relevant information. Digital signal processing methods, including Fourier transforms and wavelet transforms, are applied for frequency analysis and feature extraction.

Heart Rate Calculation:

Mathematical algorithms are used to calculate heart rate from ECG signals by measuring the time intervals between successive R waves (RR intervals) or by counting the number of R waves within a specified time window. Heart rate variability (HRV) analysis involves mathematical techniques to quantify variations in heart rate over time.

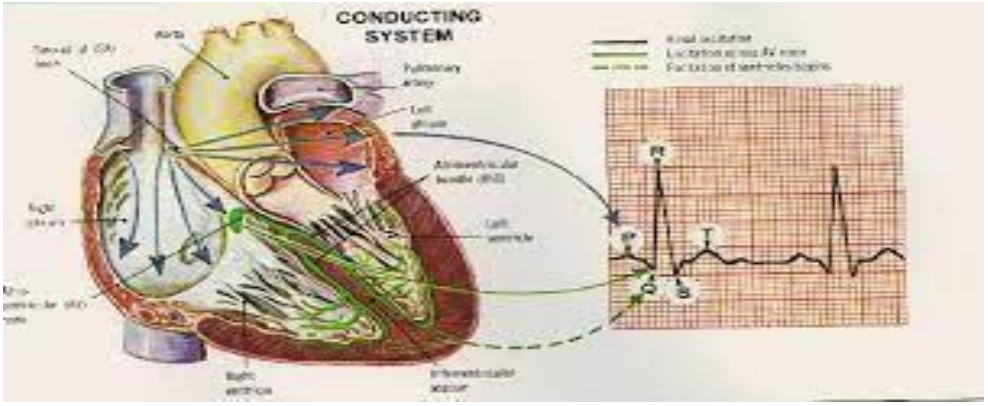
Use the formula HR = $\frac{T}{b}$ to calculate the heart rate in beats per minute

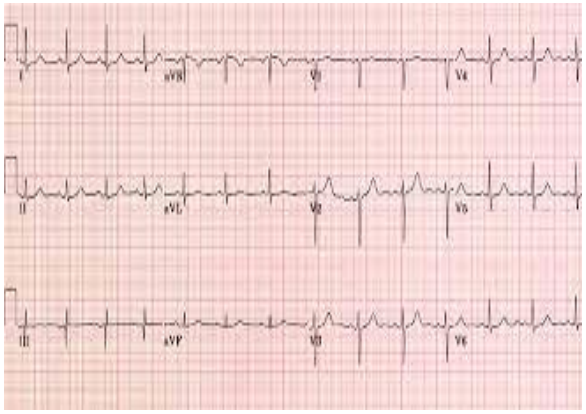
For example, If you measured heartbeats over a 2-minute interval and counted 120 heartbeats, you would calculate the heart rate as:

HR = $\frac{120}{2}$ **= 60** bpm

So, the heart rate would be 60 beats per minute.

This formula allows you to calculate the heart rate mathematically based on the number of heartbeats observed over a specific time interval.





MATHEMATICS OF MRI

MRI Use magnetic field to manipulate magnetization in a way that makes if a conveniently measurable signal which encodes spatial location and density information

Mathematically with a correctly designed sequence of magnetic field applications the recorded signal is just a 2D Fourier Transform

Fourier Transform : The forward Fourier Transform converts an image from the spatial domain into the frequency domain Mathematically it can be represented as

$$F(K_x, K_Y) = \iint_{-\infty}^{\infty} f(x, y e^{-i2\pi(k_x X + K_Y y)}\, dx\, dy$$

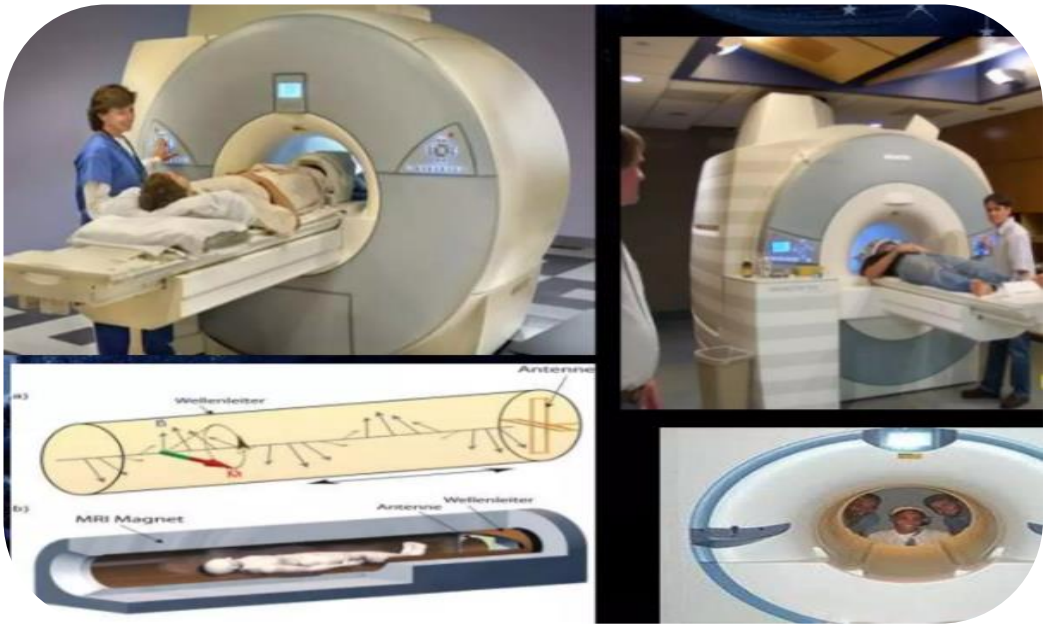
Where:

$F(K_x, K_Y)$: is the spatial frequency representation in frequency domain

$f(x, y)$: is the image in the spatial domain.

Kx and K : are the spatial frequency coordinates in frequency domain

This equations describe the fundamental process of transforming data between the spatial domain and frequency domain in MRI using the Fourier Transform



MATHEMATICAL SHAPES

In the context of tablets or pills, mathematical shapes are often employed to describe the physical form of the medication. Here are some common shapes used for tablets:

1) Cylinder
2) Rectangle
3) Oval
4) Round
5) Triangular
6) Pentagonal or Hexagonal

Cylinder:

Many tablets have a cylindrical shape, resembling a short cylinder. This shape allows for easy swallowing and manufacturing.

Examples:

Multivitamins:

Some multivitamin supplements come in cylindrical tablets. These tablets typically contain a combination of vitamins and minerals to supplement the diet.

Rectangle : Rectangular tablets are often chosen for their ease of manufacturing and packaging. They can also provide a larger surface area for imprinting dosage information and other markings. As with any medication, it's essential to follow the instructions provided by your healthcare provider or pharmacist and to use rectangular tablets as directed.

Photo Gallery

Appeals and Suggestions:

The study allows us to explore our appeals and suggestions.They are mentioned here under:

1. Let all the members in the society have to incorporate an idea that mathematics is not a subject alone it is one of the applicable subjects in the general.
2. It is also appealed that a necessary scope may be provided in the medical and pharmaceutical companies by creating certain amounts of jobs to the unemployed who have studied mathematics.
3. It in suggested that the interest part and the application is to be included in the curriculum.
4. It in appeared that the perspective way and approach towards mathematical is to be changed from traditional outlook to general outlook.