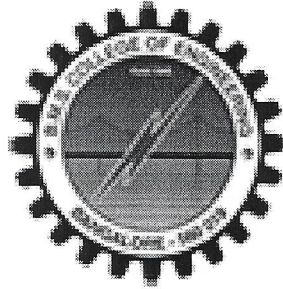# BMS COLLEGE OF ENGINEERING

DEPARTMENT OF MEDICAL ELECTRONICS

VII SEMESTER

(2019)

CLINICAL DATA ANALYTICS

(16ML7DCCDA)

LAB REPORT

STUDENT NAME	USN	MARKS OBTAINED	STUDENT SIGNATURE
GUNASHRI R·P	IBM16ML008	08	Gunashri R·P.
JAYAPRIYA·E	IBM16ML009	08	Jayapriya

Signature of the Faculty In-charge: **Dr.Kalpana R**

SS + LAB + UVA

Gunashri : 8 + 9 + 5 = 22

Jayapriya : 0 + 8 + 5 = 13

26/11/2019

- A sample of size of 16 children from a school and the number of their decayed teeth is taken. Calculate mean, median, mode, var and histogram for the given data.

3, 5, 2, 4 ,0, 1, 3, 5, 2, 3, 2, 3, 3, 2, 4, 1, 0

Matlab Code:

B = [3 5 2 4 0 1 3 5 2 3 2 3 3 2 4 1 0];

mean(B)

median(B)

mode(B)

hist(B)

mean(B)

ans =

   2.5294

median(B)

ans =

   3

mode(B)

ans =

   3

hist(B)
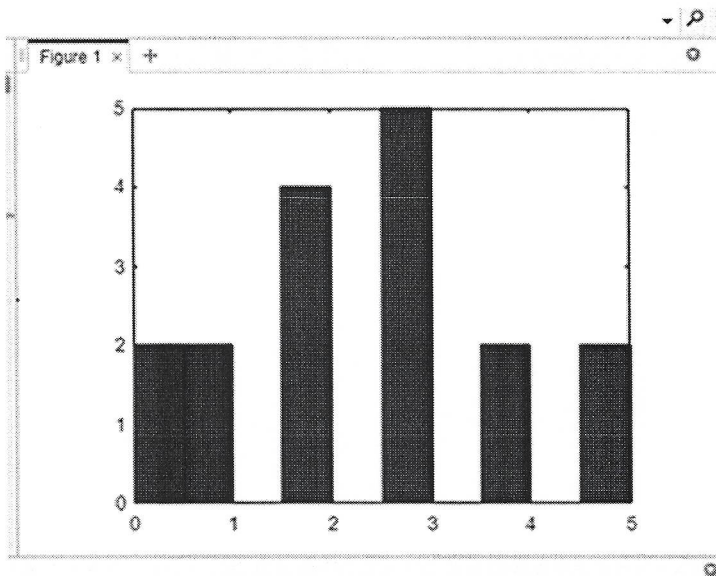
- Find the mean, median, mode, standard deviation and variance for the following data of Sample of birthweights (g) of live-born infants born at a private hospital in San Diego, California in one day.

2.069 2.581 2.759 2.834 2.838 2.841 3.031 3.101 3.200 3.45 3.248 3.260 3.265 3.200

Matlab Code

B = [2.069 2.581 2.759 2.834 2.838 2.841 3.031 3.101 3.200 3.45 3.248 3.260 3.265 3.200];

mean(B)

median(B)

mode(B)

var(B)

std(B)

hist(B)

B = [2.069 2.581 2.759 2.834 2.838 2.841 3.031 3.101 3.200 3.45 3.248 3.260
3.265 3.200];

mean(B)

ans =

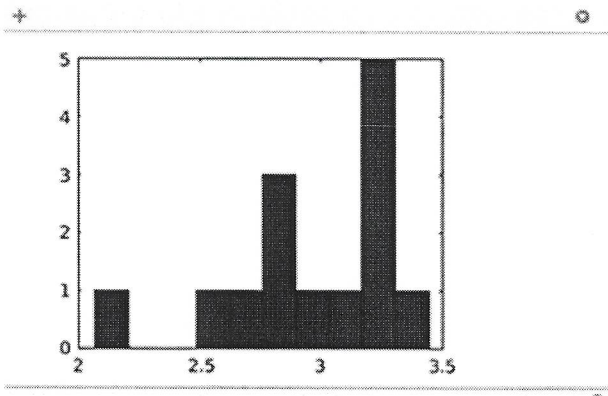   2.9769

median(B)

ans =

    3.0660

mode(B)

ans =

    3.2000

var(B)

ans =

    0.1281

std(B)

ans =

    0.3579
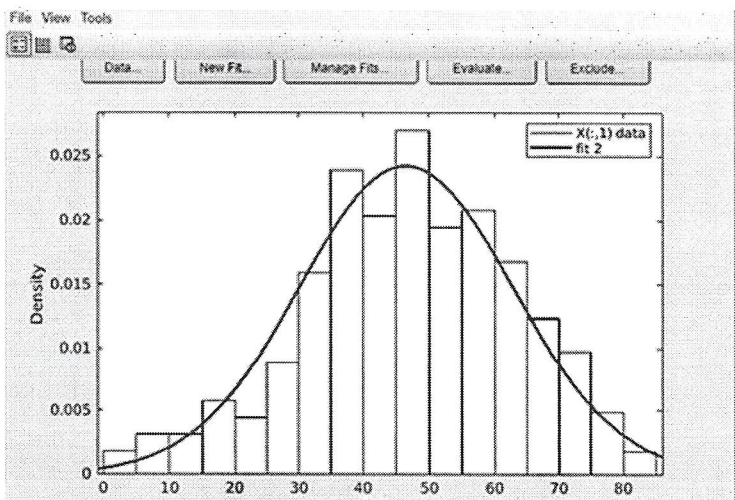
hist(B)

- Normal distribution of arrhythmia data in matlab

Matlab Code

Load arrhythmia.mat

```
─ Results:─────────────────────────────
Distribution:    Normal
Log likelihood:  -1907.06
Domain:          -Inf < y < Inf
Mean:            46.4712
Variance:        271.15

Parameter  Estimate  Std. Err.
mu         46.4712   0.774525
sigma      16.4666   0.548583

Estimated covariance of parameter estimates:
        mu           sigma
mu      0.599889    1.62622e-17
```

[Save to workspace...] [Manage Fits] [Close]

- **Poisson Distribution**

Matlab Code

Load arrhythmia.mat


```
─ Results:─────────────────────────────
Distribution:    Poisson
Log likelihood:  -2757.64
Domain:          0 <= y < Inf
Mean:            46.4712
Variance:        46.4712

Parameter  Estimate  Std. Err.
lambda     46.4712   0.320644

Estimated covariance of parameter estimates:
        lambda
lambda  0.102812
```
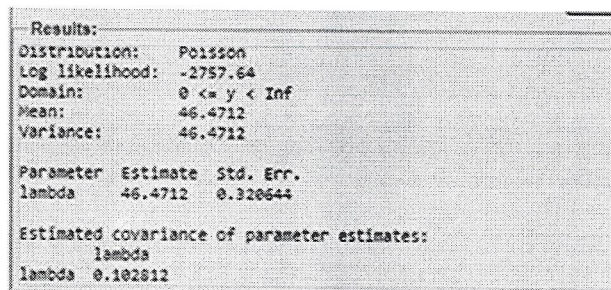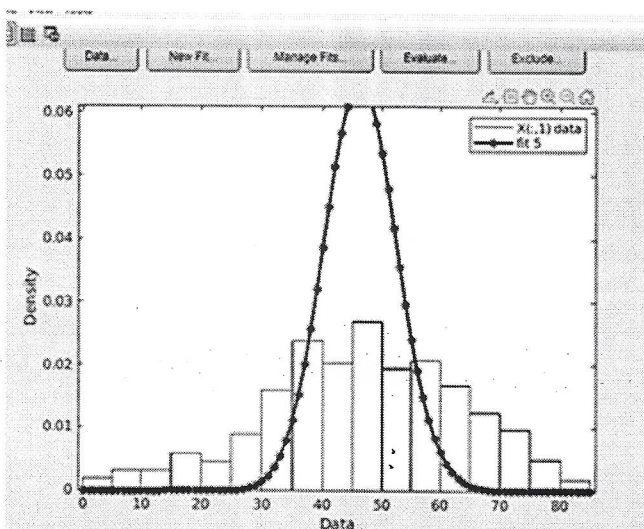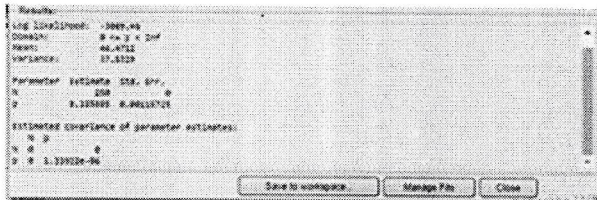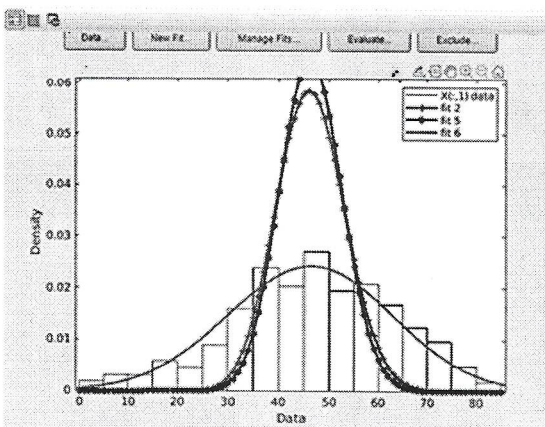
- Binomial Distribution

Matlab Code

Load arrhythmia.mat

Normal, binomial and poisson distribution applied together.

- Find the correlation coefficient between height and pulmonary anatomical dead space in 15 children.

Child number	Height (cm)	Dead space (ml), y
1	110	44
2	116	31
3	124	43
4	129	45
5	131	56
6	138	79
7	142	57
8	150	56
9	153	58
10	155	92
11	156	78
12	159	64
13	164	88
14	168	112
15	174	101

	A	B	C
1	Height(cm)	Dead space (ml)	
2	110	44	
3	116	31	
4	124	43	
5	129	45	
6	131	56	
7	138	79	
8	142	57	
9	150	56	
10	153	58	
11	155	92	
12	156	78	
13	159	64	
14	164	88	
15	168	112	
16	174	101	
17			

File   Home   Insert   Data   Review   View   Help   Tell me what you want to do   Open in Desktop App

D16 f_x =CORREL(A2:A16,B2:B16)

	A	B	C	D
1	Height(cm)	Dead space (ml)		
2	110	44		
3	116	31		
4	124	43		
5	129	45		
6	131	56		
7	138	79		
8	142	57		
9	150	56		
10	153	58		
11	155	92		
12	156	78		
13	159	64		
14	164	88		
15	168	112		
16	174	101		0.846312379
17				
18				

r = .846312379

- Suppose that 80% of adults with allergies report symptomatic relief with a specific medication. If the medication is given to 10 new patients with allergies, what is the probability that it is effective in exactly seven?

Binomial Distribution Model

We know that:

- observation is n=10
- successes or events of interest is x=7
- p=0.80

Excel code : =BINOMDIST(x,n,p,FALSE)

	A	B	C	D
1				
2	7			
3	10			
4	0.8			
5	0.2	0.201326592		
6				
7				
8				
9				
10				
11				
12				

There is a 20.13% probability that exactly 7 of 10 patients will report relief from symptoms when the probability that any one reports relief is 80%.

- Readings in the preliminary study of urinary lead concentrations among 15 patients is taken. Find the mean, median, mode and standard deviation

Lead concentration in urine(micro mol/24hr):
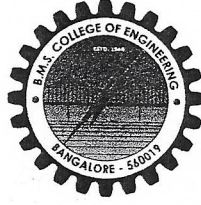.1,.4,.6,.8,1.1,1.2,1.3,1.5,1.7,1.9,1.9,2,2.2,2.6,3.2

Excel Code

Mean: =AVERAGE

MEDIAN: =MEDIAN

MODE: =MODE.SNGL

Standard Deviation: =STDEVA

Variance : =VARA

File Home Insert Data Review View Help

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T18

	A	B	C	D	E
1					
2				Lead Conc in Urine	
3				0.1	
4				0.4	
5				0.6	
6				0.8	
7				1.1	
8				1.2	
9				1.3	
10				1.5	
11				1.7	
12				1.9	
13				1.9	
14				2	
15				2.2	
16				2.6	
17				3.2	
18			MEAN	1.5	
19			MEDIAN	1.5	
20			MODE	1.9	
21			Standard Deviation	0.843462253	
22			Variance	0.711428571	

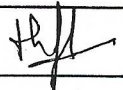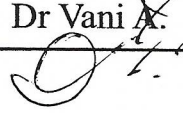Sheet1   ⊕

B. M. S COLLEGE OF ENGINEERING

Department of Medical Electronics Engineering
(Autonomous under VTU)

ALTERNATE ASSESSMENT TOOL

"Laibin B, China"

PROJECT MANAGEMENT & FINANCE
(19ES7HSPMF)

VII Semester
(2022-2023)

Name	USN	Signature
Ume Hani Jawad	1BM19ML055	
Vaishnavi Rangaraj	1BM19ML056	
Faculty In-charge		Dr Vani A.

INTRODUCTION

This case study focuses on Laibin B, one of China's first entirely foreign-owned power plants. It was meant to serve as a model for future build-operate-transfer (BOT) initiatives.

The Shajiao B plant in Guangdong Province was the first BOT power project in China, and indeed in Asia. Despite the province's success with this BOT project, the central government became concerned that when BOT projects were competitively bid, based on the price of power, developers would have opportunities to make excessive profits, and the government had no other financial controls over such projects.

Laibin B was the first pilot project under a new legislative and regulatory architecture designed to enable BOT projects; its structure was designed to serve as a model for future BOT projects. This project's two significant novelties were that the concession was given through a competitive bidding procedure and that it was entirely foreign-owned.

PROJECT SUMMARY

The project included the funding, design, construction, procurement, operation, and maintenance of a 2 x 360 MW coal-fired power plant in Laibin County, Guangxi Zhuang Autonomous Region (Guangxi Province). The $616 million project is wholly foreign-owned and foreign-financed. Construction began in September 1997 and was projected to take three years to complete. After 15 years of commercial operation by the two project sponsors, the Concession Agreement provided for the project to be entrusted to the Guangxi autonomous regional government. Guangxi, which borders Vietnam, is one of China's poorest regions, therefore the Guangxi Power Industry Bureau's (GPIB) credit risk was a problem. Furthermore, there had been little foreign investment in the area at the time, and the provincial government of Guangxi had little exposure to the international syndicated credit market.

The project firm is a completely foreign-owned Chinese corporation. It is owned 60% by Électricité de France International (EDFI) and 40% by Alstom, previously GEC Alsthom. EDFI is completely owned by Électricité de France (EDF), which is wholly controlled by the French government. General Electric Company plc of the United Kingdom and Alcatel Alsthom of France jointly controlled GEC Alsthom until its first public offering in 1998, when it was renamed Alstom. Alsthom Export Compagnie Financière de Valorisation pour L'Ingénierie and the Construction Services Contractor formed a special-purpose joint venture. GEC Alsthom Centrales Energetiques SA and EDF, operating via its business CNET, formed the Equipment Supplier consortium.

The Operator is an EDFI-owned company that is 85 per cent controlled by the GPIB, the Guangxi government's power purchase organisation, and the Guangxi Investment and Development Company, Ltd.

BACKGROUND

The need for power

In recent years, the People's Republic of China has had one of the world's fastest expanding economies, with annual GDP growth averaging 12 to 14% and a requirement to create additional power-generating capacity at a comparable rate. China was fourth in installed generating capacity but 80th in per-capita energy consumption in the mid-1990s. Approximately 120 million rural dwellers lacked access to electricity. 3 As a result, the government intended to install 35,000 megawatts of new, independently generated power capacity by the turn of the century.

approved by the State Council, SPC, MOP, Ministry of Foreign Trade and Economic Cooperation (MOFTEC), the MOEP, the State Administration of Exchange Control (SAEC), the Tax Bureau, the Pricing Bureau, the Guangxi Provincial Government, the Guangxi MOFTEC, the Guangxi SAEC, and the GPIB.

CONTRACTS

Three significant contracts—the Concession Agreement, the PPA, and the FSTA—support the Laibin B project.

Concession Agreement

The Concession Agreement is the umbrella agreement that summarises the project company's and the Guangxi Province government's principal rights and duties with regard to the concession. The Guangxi government is the major obligor under the PPA and the FSTA, as well as the consortium's counterparty under the Concession Agreement. The Concession Agreement specified the concession period, which will last 18 years, including the three-year construction phase, beginning on September 3, 1997, the date the tender was signed. The consortium had the authority to own, operate, mortgage, and delegate the right to operate all project assets, machinery, and facilities during the duration of the concession.

Power Purchase Agreement

The off-taker, GPIB, consented to purchase about 63% of the plant's production based on a 100% baseload factor. The sponsors believed that a 63% output level would be adequate to cover the project debt, and thereby saw a potential for profit on power sales above that level. The project funders had excellent reasons to anticipate high demand for additional electricity capacity. First, Guangxi Province was running out of power, and demand was predicted to rise by 13% every year. Second, much of the Guangxi grid was powered by hydropower, which was inefficient during the dry season. Laibin B, being a coal-fired facility, would be reliable all year. The PPA stipulated a fixed tariff with pre-agreed-upon yearly modifications. This was in contrast to the Chinese government's prior approach to projects including foreign investment, which attempted to limit developers' IRRs to around 15%. The tariff is paid in Chinese yuan. The sponsors carried the foreign exchange risk for the first 5% of the tariff, after which the tariff was increased to reflect the Chinese currency's depreciation against the US dollar.

Fuel Supply and Transportation Agreement

The Guangxi province government committed to supplying fuel to the project through its subsidiary, the Guangxi Construction and Fuel Corporation, under the terms of the FSTA (GCFC). The project sponsors had the ability to reject coal that did not meet the agreement's standards. The basic price was established every year, but the price of each delivery was adjusted based on the quality of the coal, which fell within a certain range. The FSTA identified the mines that would provide the coal and was accompanied by a letter of assurance from the GCFC guaranteeing the sponsors of alternate coal sources.

RISK ANALYSIS

One of the major reasons for the success of the project was risk analysis. The two biggest risks for this specific project were counterparty credit and tariff adjustment. Analysis and timely action to mitigate these risks contributed to the project being completed on time and without hiccups.

Operating risks

While the project company and the Guangxi government shared some operating risks related to labour or a force majeure event, the project company bore most of the other operating risks related to operator ability, environmental damage, technology, and prolonged downtime.

CONCLUSIONS

The development of a foolproof plan, which included funding, drafting tenders, choosing the best contractors, financing, and risk management, was a key factor in Laibin's success.
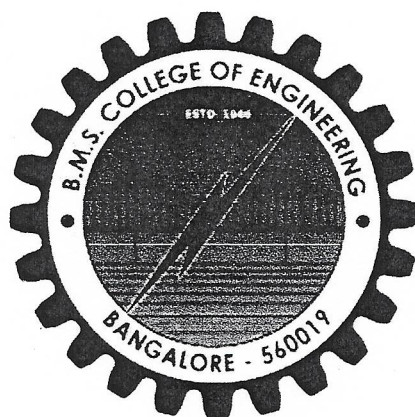
B.M.S COLLEGE OF ENGINEERING

BULL TEMPLE ROAD, BASAVANGUDI-560019

A report for

ANALOG MICROELECTRONIC CIRCUITS

Prof: Dr K.Vijayalakshmi

TOPIC: Simulation of fire alarm using 555 timer (IC)

Name	USN	marks	sign
1) Chaithra Kuriedath	1BM21MD013	9	
2)Bhagya Lakshmi	1BM21MD007	9	Bhagya-G.

Vijayal 25/2/2023

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1.	INTRODUCTION
2.	COMPONENTS
3.	CONTENT
4.	CIRCUIT DIAGRAM
5.	EXPLANATION
6.	RESULTS
7.	CONCLUSION
8.	PO'S

INTRODUCTION

Fire alarms are prime necessities in modern buildings and architectures, especially in banks, data centers and gas stations. They detects the fire in ambiance at very early stage by sensing smoke or/and heat and raise an alarm which warns people about the fire and furnish sufficient time to take preventive measures. It not only prevents a big losses caused by deadly fire but sometimes proves to be life savers. Here we are building one simple fire alarm system with the help of 555 Timer IC, which will sense the fire (temperature rise in surrounding), and trigger the alarm.

The key component of the circuit is Thermistor, which has been used as fire detector or fire sensor. Thermistor is temperature sensitive resistor, whose resistance changes according

to the temperature, its resistance decreases with the increase in temperature and vice

versa. Here we use a variable resistor instead of thermistor in the simulation.

We have built the circuit using, mainly three components that is, Thermistor (variable resistor), NPN transistor and 555 Timer IC.

Components

555 Timer IC ,NPN Transistor BC547 Thermistor (10K) ,Resistors (1K, 100K, 4.7K) ,Variable resistor(1M) ,Capacitor (10uF) ,Buzzer and Battery (9v).

CONTENT

Working Concept

Here the 555 time IC has been configured in astable mode so that Alarm (Buzzer) can produce an oscillating sound. In astable mode,

Capacitor C charges though resistance R1 and R2, till 2/3 Vcc and discharges through R2 till it reaches to 1/3Vcc. During the charging time OUT PIN 3 of 555 IC remains HIGH and during discharging it remains LOW, that's how it oscillate. We have connected a Buzzer to OUT pin, so that it produce beep sound, when 555 is high. We can control the oscillation frequency of the alarm by adjusting the value of R2 and/or capacitor C.

Circuit Diagram and Explanation
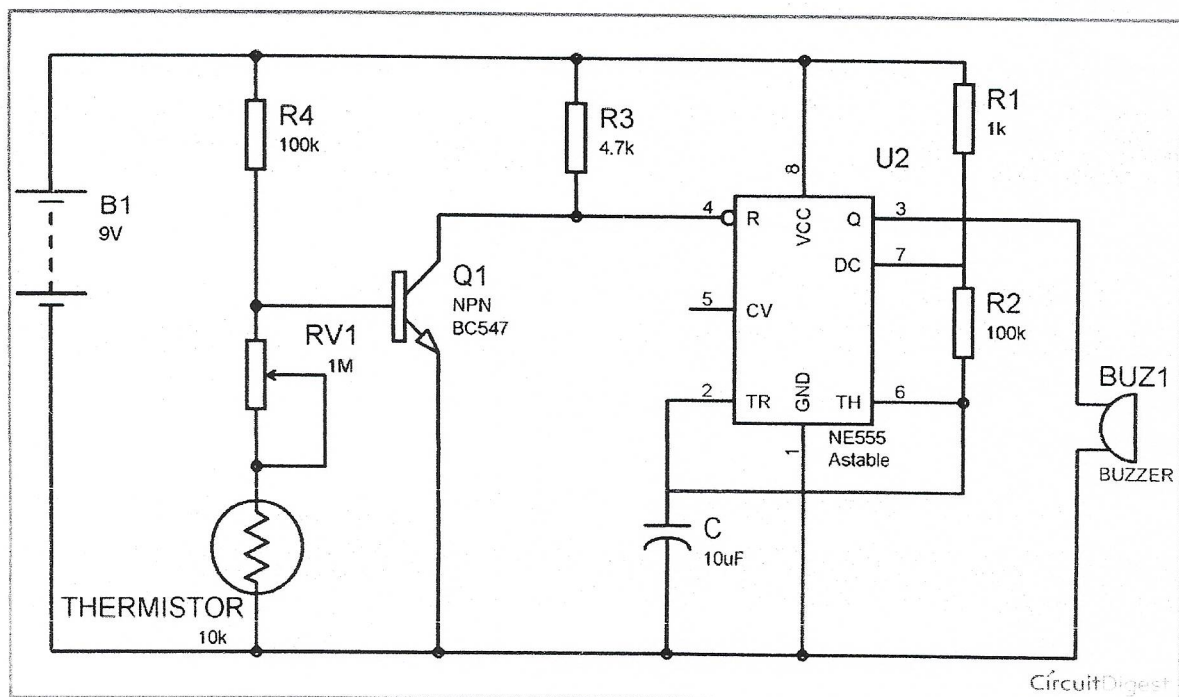
We can see the circuit diagram of fire alarm in above figure. When there is no FIRE, thermistor remains at 10k ohm. And transistor remains at ON state because there is sufficient voltage across the base-emitter of transistor, which makes it ON. When the Transistor is ON, Pin 4 (RESET) is connected to the Ground, and when Reset pin is grounded, 555 IC doesn't operate.

Now when we start heating the Thermistor through Fire, its resistance starts to decrease, and when its resistance decreases, the voltage at the base of Transistor starts to decrease and when the voltage becomes less than the operating voltage (base-emitter voltage VBE) of transistor, then transistor becomes OFF. And when transistor becomes OFF, Reset pin of 555 timer IC, gets positive voltage through R3, and 555 IC starts to work and buzzer beeps.

n transistor, usually 0.7v voltage is required across the Base and Emitter, to turn it ON. So we have to carefully adjust the value of Variable resistance RV1 and Thermistor, to make the circuit work properly. To do this remove the thermistor and let RV1 be the grounded, now adjust the value of RV1 to that point, where even slight turning of the RV1 starts the Buzzer. Means from this point, if we decrease the resistance, even very little, Buzzer starts to beep. Now at this point, connect the thermistor again.
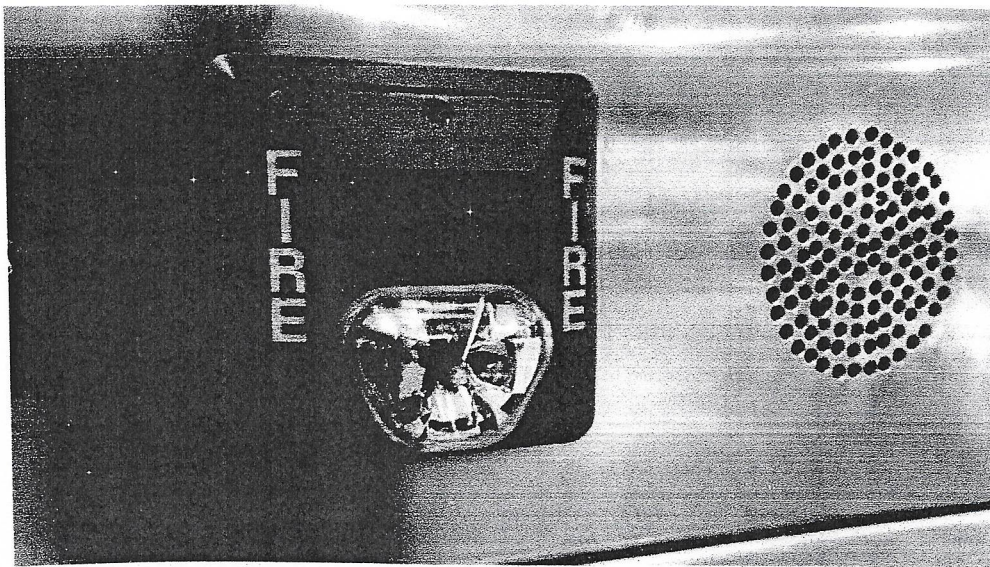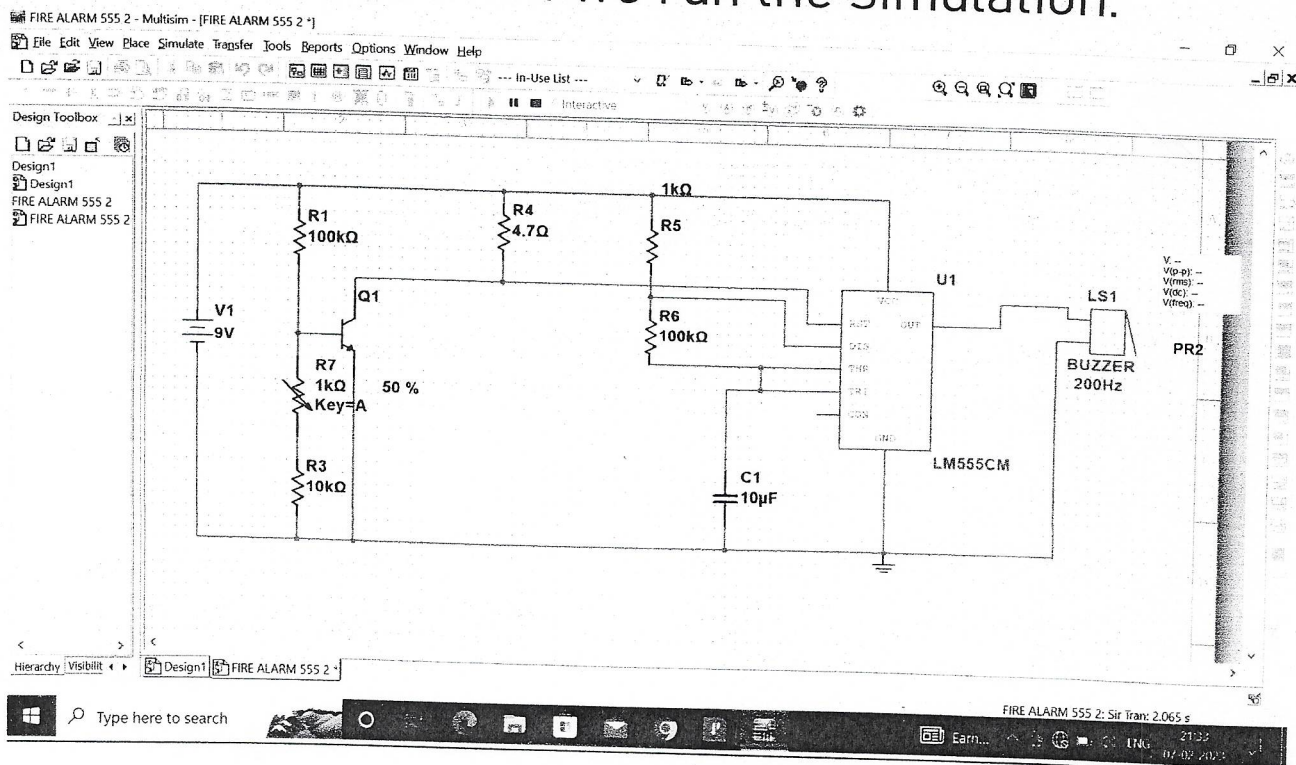
Applications:

Applications:

- Fire alarm in office
- Remote LCD annunciator
- Fire alarm in hotel rooms
- Fire alarm in schools
- Fire alarm projects

RESULTS

The circuit is made for the fire alarm using 555 IC and results is obtained and we can hear the buzzer sound when we run the simulation.

CONCLUSION

Thus we came out with the circuit we tried to implement .This is not only used in house but also in any type of buildings for safety purposes.

REFERENCE

electroaurdino.com

https://www.electronicshub.org/simple-fire-alarm-circuit/#Circuit_Design

https://www.elprocus.com/fire-alarm-circuit-using-thermistor

PO'S

PO2	Ability to identify, analyze a problem, and formulate the computing requirements appropriate to its solution.
PO9	An ability to function effectively as an individual and a member in diverse team.
PO10	An ability to communicate effectively with a range of audience.
PO11	An ability to understand management principles and apply this to manage projects and finance.
PO12	An ability to engage in continuing professional development for life long learning.

B.M.S. College of Engineering, Bengaluru

Department of Medical Electronics Engineering

19ML5PE2BM - BIOMATERIALS

AAT Report

on

TOPIC: POLYANILINE WITH CURCUMIN

Submitted By

PRATHIKSHA HARISH - 1BM20MD035

KRITHIK RAJ K - 1BM20MD023

ABHINAV RAJKUMAR – 1BM20MD002

Academic Year 2022-23

Content

1. Introduction to Biomaterials:

- A biomaterial is a substance that has been created specifically to interact with biological systems for therapeutic or diagnostic purposes in medicine.
- Biomaterials has been a field of study for about fifty years. Biomaterials science or biomaterials engineering is the study of biomaterials.
- In the lab, biomaterials can be created using a number of chemical techniques using metallic or polymeric components, ceramics, or composite materials. Biomaterials can also be obtained from nature.
- They frequently serve and/or are modified for medical purposes, and as a result, they might be all or part of a living structure or biomedical device that replaces, augments, or performs a natural function.
- Such functionalities may be comparatively inactive, like those found in a heart valve, or they may be bioactive with a more interactive functionality, like those seen in hip implants covered in hydroxyapatite.

Turmeric can be used to create a biomaterial with the following properties:

1. Antioxidant and anti-inflammatory: Turmeric has natural antioxidants and anti-inflammatory properties, which can be beneficial in medical applications.

2. Biocompatibility: Turmeric has been found to be biocompatible, meaning it does not cause an adverse reaction when used in contact with living tissue.

3. Biodegradability: Turmeric is a natural, biodegradable material, which makes it a suitable candidate for use in biodegradable medical devices and implants.

4. Non-toxicity: Turmeric is generally considered non-toxic, making it safe for use in medical applications.

5. Mechanical strength: The mechanical strength of a turmeric-based biomaterial can vary depending on the processing and formulation, but in general, it has been found to have good mechanical properties, making it suitable for use in load-bearing applications.
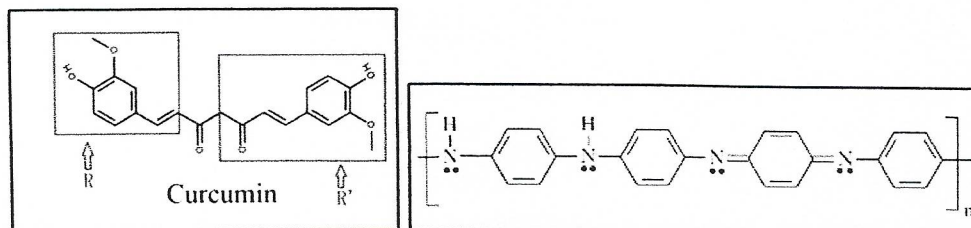
6. Antimicrobial properties: Turmeric has been shown to have antimicrobial properties, making it a potential candidate for use in medical devices to prevent infection.

7. Surface chemistry: The surface chemistry of a turmeric-based biomaterial can be tailored to improve its performance and interaction with living tissues.

INTRODUCTION TO POLYANILINE :

Materials containing polyaniline (PANI) have a wide range of recognised uses in a variety of industries, including electrical and electrochemical devices, electrochemically active membranes, and stimuli-responsive systems. The majority of interest in the field of developing biomaterials for tissue engineering and medication delivery systems has been drawn to these materials. PANI has outstanding qualities such simplicity in synthesis, high electrical conductivity, particularly in the doped condition, ease of modification to increase water processability, and improved biocompatibility. In the procedure known as electrical stimulation (ES), cells cultivated on the produced biomaterial can be electrically stimulated, an engineered PANI-based biomaterial can be used. The ES modifies cellular behaviour and imitates the natural function of bioelectricity.

2. Description of the work and results

A blend of Turmeric and Polyaniline.

Curcumin

INTRODUCTION

Nanofibrous substrate consisting of turmeric and polyaniline nanoparticles that exhibit topological and biological features that mimic the natural extracellular matrix for nerve cells.

We evaluated the morphology of 2-dimensional fibrous substrates, and their ability of stem cell adhesion, growth and proliferation rate was influenced by the use of various concentrations of turmeric in substrates.

INTRODUCTION TO SEM CHARACTERIZATION :

Scanning Electron Microscopy (SEM) is a type of electron microscopy that uses a beam of electrons to produce high-resolution images of the surface of a sample. SEM can be used to characterize the morphological features of a sample, such as size, shape, and distribution of particles.
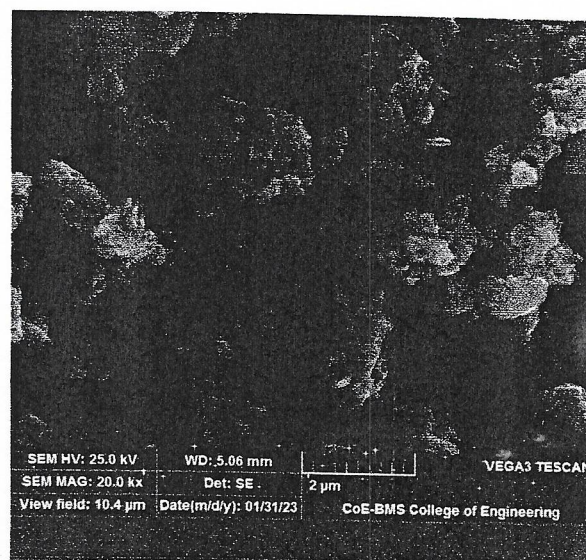
When turmeric is mixed with polyaniline, the SEM images can reveal the distribution and interaction between the turmeric and polyaniline particles. The images can also provide information on the surface characteristics, such as roughness, porosity, and homogeneity, of the sample. Additionally, SEM can be used to examine the effect of the mixture on the electrical conductivity and electroactivity of the sample, which can be important in applications such as energy storage and sensors.

RESULTS

The results showed that 0.62 wt% of Turmeric and 0.28 wt% of nanoparticles in nanofibers substrate exhibited the optimal cellular microenvironment to accelerate cellular activities, It also showed that substrate significantly stimulated the proliferation, differentiation, and spontaneous outgrowth and extension of neurites from the cells.
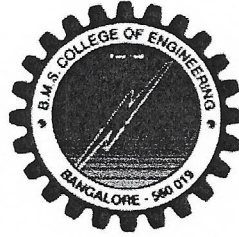
SEM characterization was done to the sample and the following image was obtained with the below inference:

- No rod like structures were found.
- It is distributed uniformly in the composite substrate as compared to pure nanoparticle substrates, due to the strong cytocompatibility of Turmeric.
- The compound shows plate like formation , but under further magnification we can clearly observe more distinctively.

3. Learning Outcomes

1. Understanding of the basic concepts and principles of biomaterials science, including their definition, classification, and properties.

2. Awareness of the factors that influence the performance of biomaterials, such as biocompatibility, biodegradability, and mechanical properties.

3. Familiarity with the fabrication techniques and processing methods used to produce biomaterials.

4. Familiarity with SEM Characterization and the procedure followed while preparing a Material for SEM Characterization.

5. Understanding of the testing and evaluation methods used to assess the performance of biomaterials post SEM Characterization.

6. Ability to critically analyze and evaluate the potential benefits and limitations of different biomaterials for various applications in medicine and biology.

7. Awareness of current trends and developments in biomaterials research and their potential impact on future medical and biological applications.

8. Knowledge of the regulatory and ethical considerations involved in the development and use of biomaterials, including intellectual property, safety, and clinical trials.

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

ALTERNATIVE ASSESSMENT TOOL
DIGITAL SIGNAL PROCESSING
[19ES5CCDSP]

Faculty In-Charge: Prof_SIRASAPPA.Y.PATTAR

**Topic:** Removing High Frequency Noise From ECG Signal

TEAM MEMBER'S:

|	
NARASHIMHA	1BM20MD031
PRAMOD B R	1BM20MD034
RAHUL	1BM20MD038
ROHAN GOWDA	1BM20MD039

03/02/2023

ACKNOWLEDGEMENT

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work on this topic. Thank you, Sir, for your
constant guidance, support and
encouragement. We have learnt a great deal
under your guidance. We would also like to
thank our parents for their support
and well wishes.

INTRODUCTION:
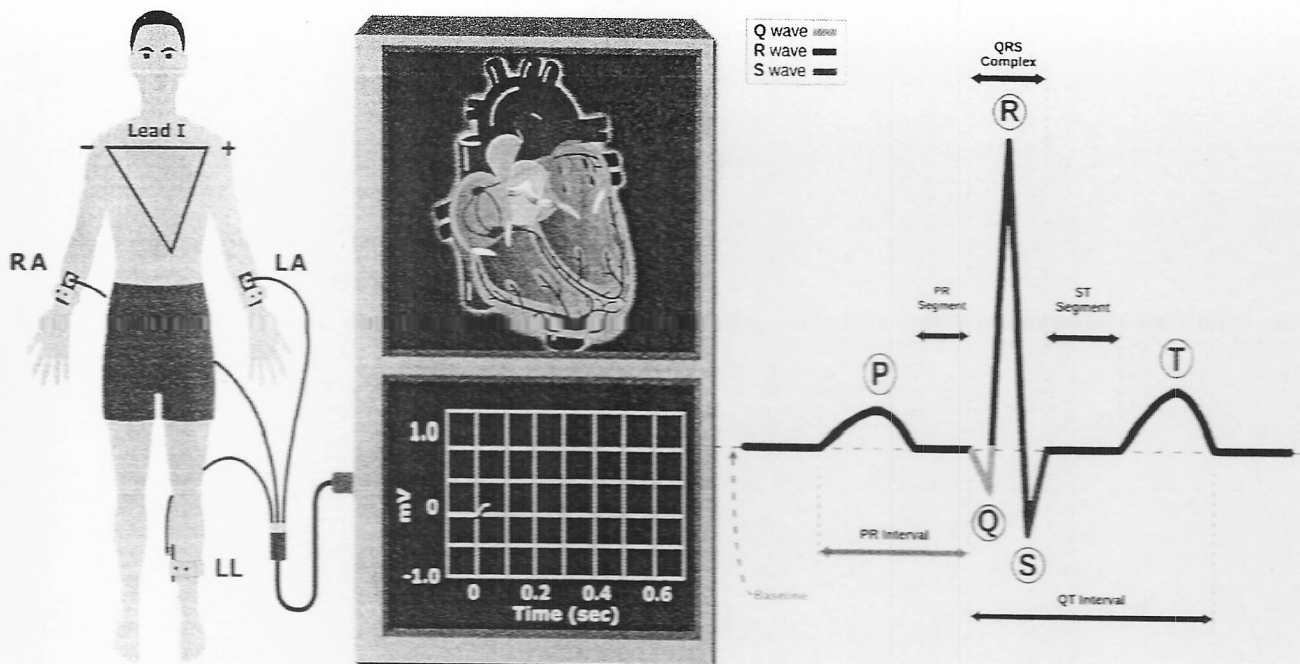
- Electrocardiography Is The Process Of Producing An Electrocardiogram (ECG)
- It is the graph of voltage versus time of the electrical activity of
- The heart using electrodes placed on the skin
- It provides a wealth of information and remains an essential part of the assessment of cardiac patients
- An electrocardiogram records the electrical signals in the heart. It's a common and painless test used to quickly detect heart problems and monitor the heart's health.

WORKING PRINCIPLE OF ELECTROCARDIOGRAPH:

- Technician
- Trace
- Chest electrode
- ECG machine
- Ankle electrode
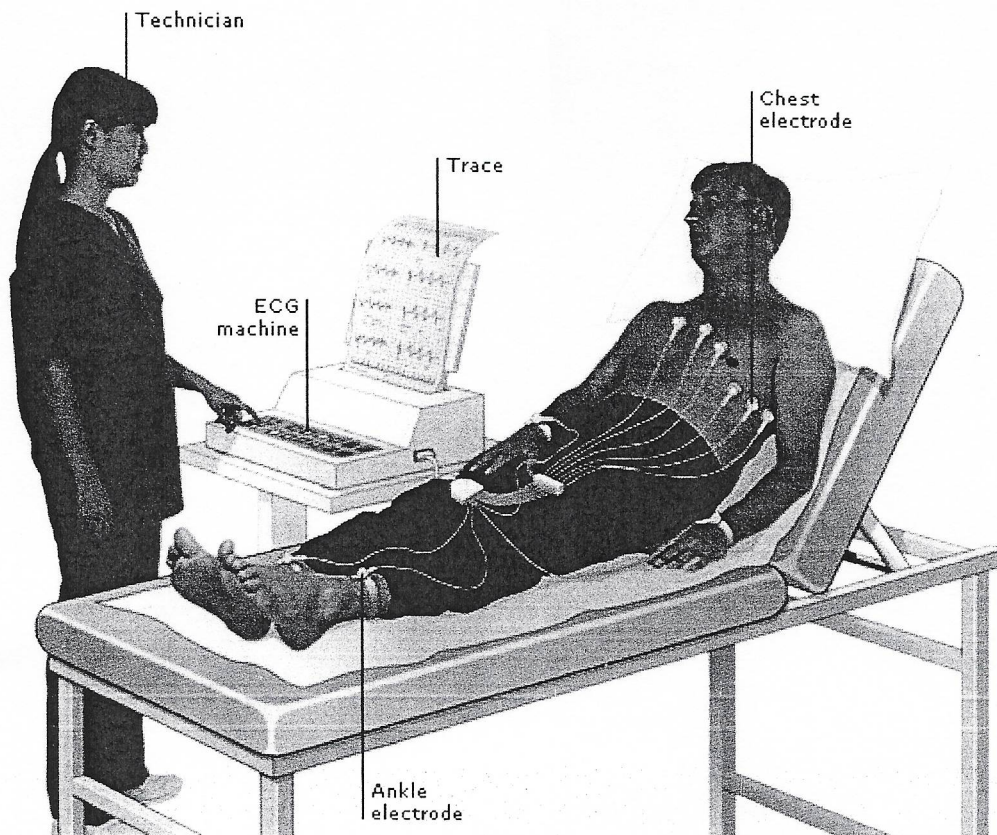
- It works on the principle that a contracting muscle generates a small electric current that can be detected and measured through electrodes suitably placed on the body.

- For a resting electrocardiogram, a person is made to lie in the resting position and electrodes are placed on arms, legs and at six places on the chest over the area of the heart. The electrodes are attached to the person's skin with the help of a special jelly.

- The electrode picks up the current and transmit them to an amplifier inside the electrocardiograph. Then electrocardiograph amplifies the current and records them on a paper as a wavy line.

- In an electrocardiograph, a sensitive lever traces the changes in current on a moving sheet of paper.

- A modern electrocardiograph may also be connected to an oscilloscope, an instrument that display the current on a screen
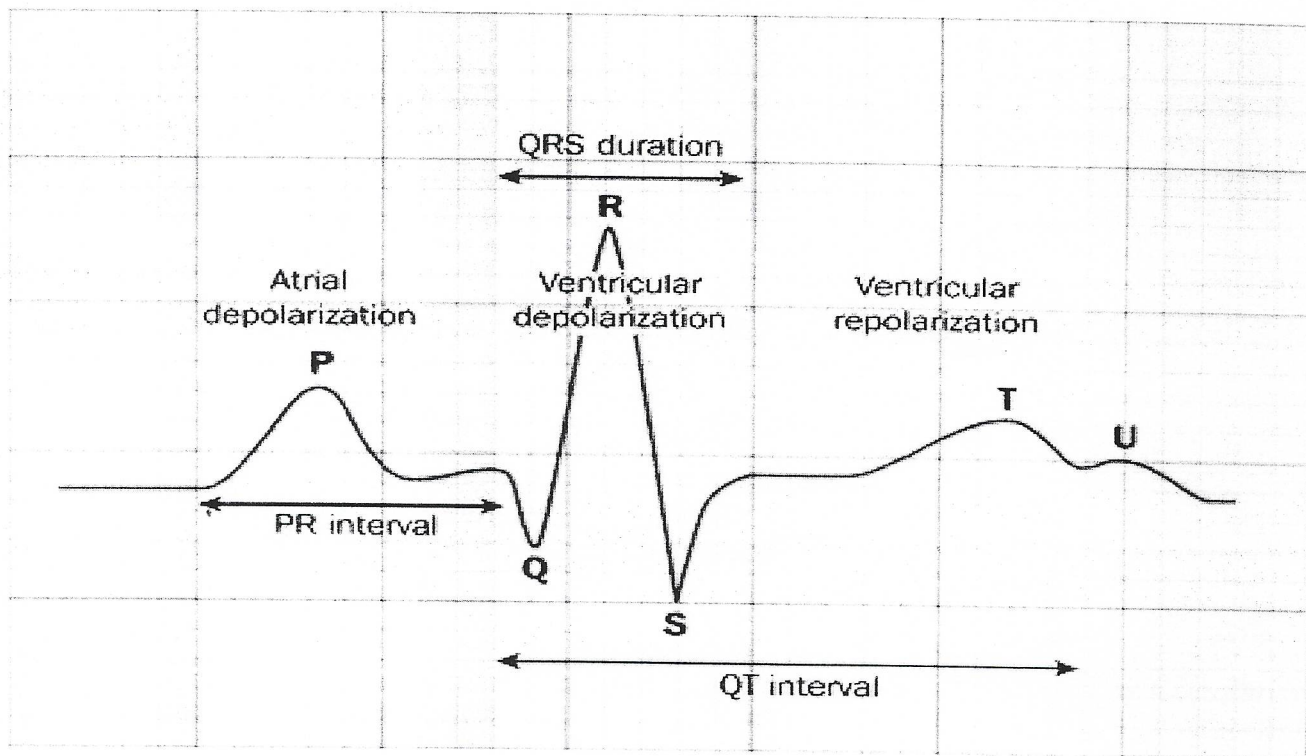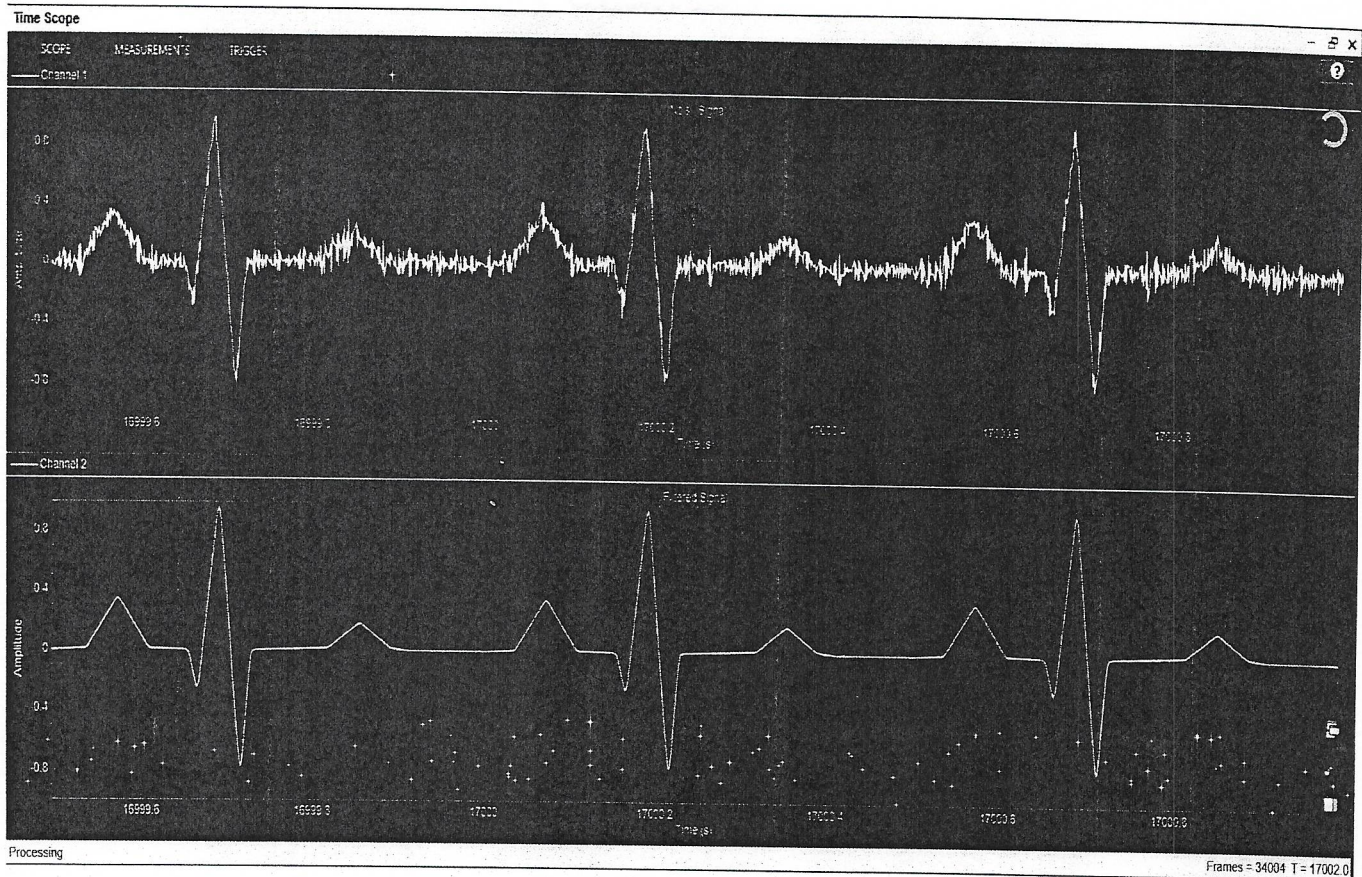
MATLAB CODE:

```
%% Removing High-Frequency Noise from an ECG Signal
% This example shows how to low pass filter an ECG signal that
contains high frequency
% noise.


%%
% Create one period of an ECG signal. The |ecg| function creates
an ECG signal
% of length 500. The |sgolayfilt| function soothes the ECG
signal using a
% Savitzky-Golay (polynomial) smoothing filter.
x = ecg (500).';
y = sgolayfilt(x,0,5);
[M,N] = size(y);
% Initialize the time scope to view the noisy signal and the
filtered
% signal.
Fs = 1000;
TS = timescope('SampleRate',Fs,...
                'TimeSpanSource','Property',...
                'TimeSpan',1.5,...
                'ShowGrid',true,...
                'NumInputPorts',2,...
                'LayoutDimensions',[2 1]);
TS.ActiveDisplay = 1;
TS.YLimits = [-1,1];
TS.Title = 'Noisy Signal';
TS.ActiveDisplay = 2;
TS.YLimits = [-1,1];
TS.Title = 'Filtered Signal';
%%
% Design a minimum-order low pass filter with a passband edge
frequency of 200
% Hz and a stopband edge frequency of 400 Hz. The desired
amplitude of the frequency
% response and the weights are specified in |A| and |D| vectors,
respectively. Pass
% these specification vectors to the |firgr| function to design
the filter
```
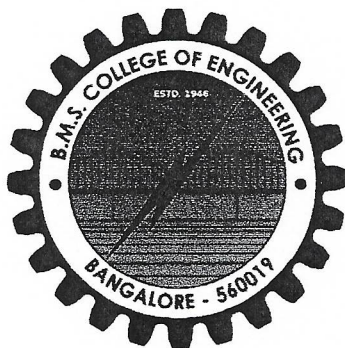
OUTPUT.

Time Scope

QRS duration

R

Atrial depolarization

Ventricular depolarization

Ventricular repolarization

P

T

U

PR interval

Q

S

QT interval

BMS COLLEGE OF ENGINEERING

(Autonomous College under VTU)

Bull Temple Road, Basavanagudi, Bangalore – 560019

DIGITAL CIRCUITS

(21ES3GCDCS)

AAT report on "4-Bit Parallel Adder/Subtracter using Logisim"

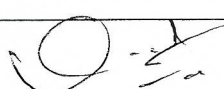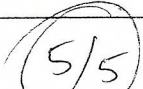**SUBMITTED BY:**

Sukruthi .S

1BM21MD038

BRANCH: MEDICAL ELECTRONICS

COURSE INSTRUCTOR:

Dr. Vani A

Assistant Professor,

Dept. of Medical Electronics Engineering, BMSCE

NAME	USN	SIGNATURE	MARKS
Sukruthi S	1BM21MD038		5/5

INTRODUCTION

In Digital Circuits, A Binary Adder-Subtractor is capable of both the addition and subtraction of binary numbers in one circuit itself. The operation is performed depending on the binary value the control signal holds. It is one of the components of the ALU (Arithmetic Logic Unit).

The circuit consists of 4 full adders since we are performing operations on 4-bit numbers. There is a control line K that holds a binary value of either 0 or 1 which determines that the operation is carried out is addition or subtraction.
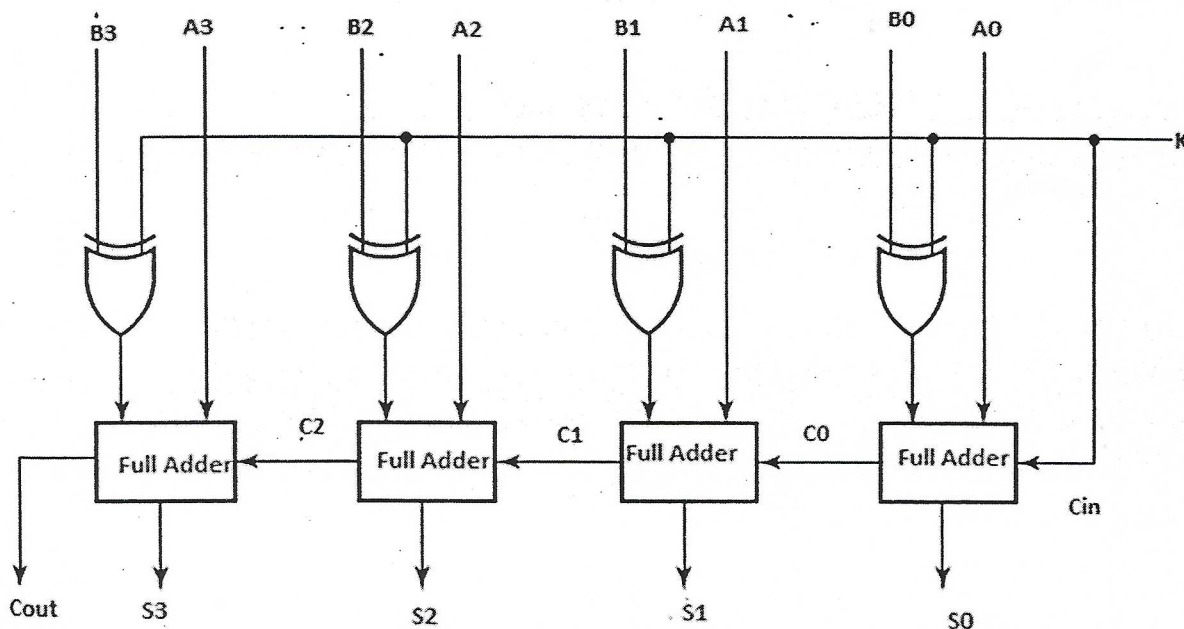
COMPONENTS USED:

Basic gates:

- AND Gate
- OR Gate

Universal gates: XOR Gate

CIRCUIT DIAGRAM:

WORKING:

As shown in the figure, the first full adder has a control line directly as its input (input carry C in), The input A0 (The least significant bit of A) is directly input in the full adder. The third input is the exor of B0 and K. The two outputs produced are Sum/Difference (S0) and Carry (C0).

If the value of K (Control line) is 1, the output of B0(exor)K=B0'(Complement B0).Thus the operation would be A+(B0'). Now 2's complement subtraction for two numbers A and B is given by A+B'+C in. This suggests that when K=1, the operation being performed on the four-bit numbers is subtraction.

Similarly, if the Value of K=0, B0 (exor) K=B0. The operation is A+B which is simple binary addition. This suggests that When K=0, the operation is performed on the four-bit numbers in addition.

TRUTH TABLE:

M	A0	A1	A2	A3	B0	B1	B2	B3	S0	S1	S2	S3	C
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	1	0	1	0	1	1	0	1	0	0
0	1	0	0	0	1	0	0	0	0	0	0	0	1
1	1	0	1	0	1	0	1	1	1	1	1	1	0
1	1	1	1	0	1	1	1	1	1	1	1	1	0
1	1	0	1	0	1	1	0	1	1	1	0	1	0

PROCEDURE:

To design a 4-bit parallel adder/subtractor use four full-adders with a 4-bit input A, and a 4-bit input B, whose bits may be XOR'd based on the mode chosen. The mode will be decided by bit M in the circuit .

For subtraction M = 1. 1 is chosen because M acts as the carry-in. Therefore, all bits of B will be inverted and 1 will be added to the LSB to find the 2's complement.

For addition, M = 0. Therefore, carry-in is set to zero as desired.

RESULTS:

Top window:

Logsim 4bit of Untitled 2 - Google Chrome

static.rollapp.com/...

File Edit Project Simulate Window Help

Wiring
- Splitter
- Pin
- Probe
- Tunnel
- Pull Resistor
- Clock
- 1 - Constant
- Power
- Ground
- Transistor
- Transmission Gate
- Bit Extender

Gates
- NOT Gate
- Buffer

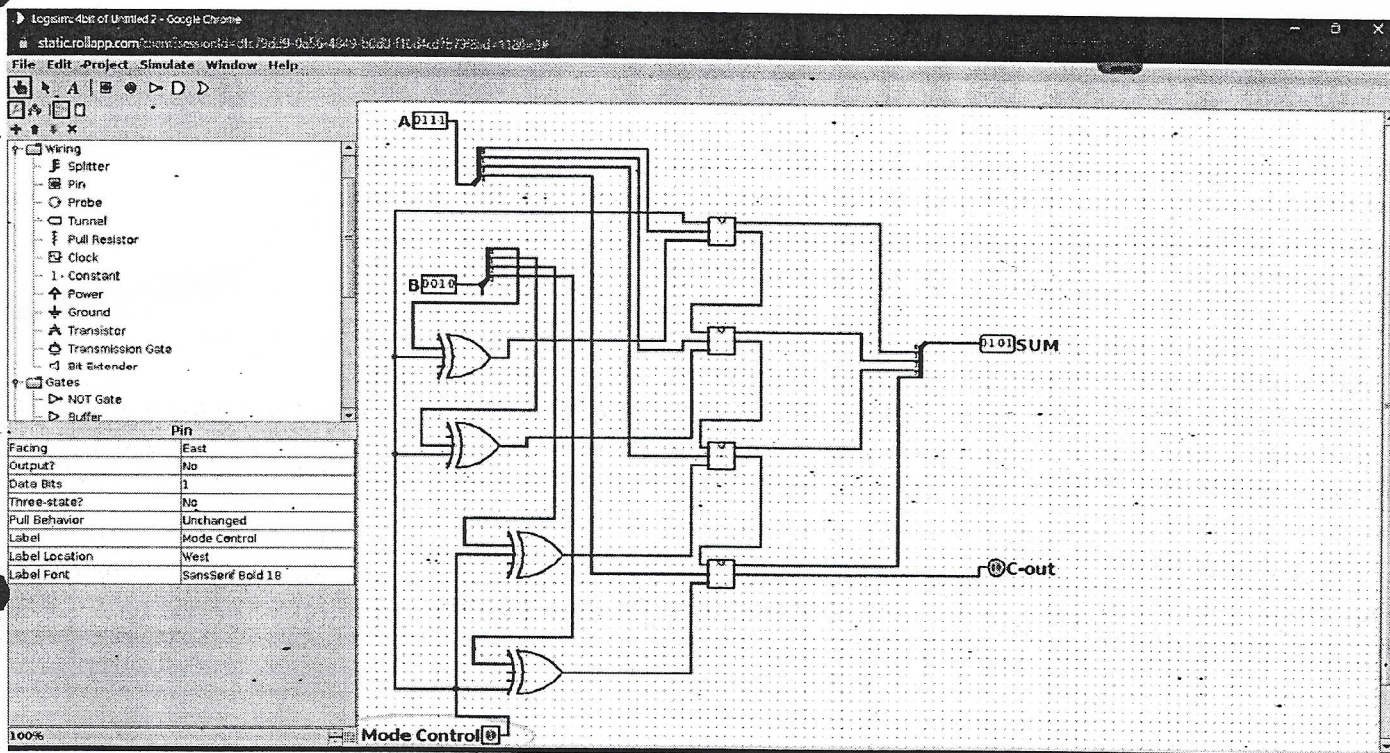| Pin	
Facing	East
Output?	No
Data Bits	4
Three-state?	No
Pull Behavior	Unchanged
Label	B
Label Location	West
Label Font	SansSerif Bold 18

A 0111
B 0010
1001 SUM
C-out
Mode Control

100%

Bottom window:

Logsim 4bit of Untitled 2 - Google Chrome

static.rollapp.com/...session id=d1c79d39-9a56-4849-b0d0-f1b84cd5798d-1120=1

File Edit Project Simulate Window Help

Wiring
- Splitter
- Pin
- Probe
- Tunnel
- Pull Resistor
- Clock
- 1 - Constant
- Power
- Ground
- Transistor
- Transmission Gate
- Bit Extender

Gates
- NOT Gate
- Buffer

Pin	
Facing	East
Output?	No
Data Bits	1
Three-state?	No
Pull Behavior	Unchanged
Label	Mode Control
Label Location	West
Label Font	SansSerif Bold 18

A 0111
B 0010
0101 SUM
C-out
Mode Control

100%

B.M.S. College of Engineering, Bengaluru

Department of Medical Electronics Engineering

Embedded System Design with ARM

(19ML5PCESD)

AAT Report

On

INSULIN PUMP IMPLEMENTATION USING ARM CORTEX-M3

Submitted By

Apoorva M S– 1BM20MD005

Sakshi Marodia – 1BM20MD043

Vani S R – 1BM20MD055

Academic Year 2022-23

Contents

INTRODUCTION

An insulin pump is a medical device used by people with diabetes to deliver insulin into their body. The insulin pump is a small, computerized device that is attached to the body and delivers insulin continuously throughout the day. It is an alternative to traditional insulin injections, which are given several times daily.

The importance of insulin pumps for people with diabetes lies in the fact that they can help improve the overall control of blood sugar levels, reduce the frequency and severity of hypoglycemic episodes, and improve the quality of life for those living with diabetes.

Statistics show that the use of insulin pumps has increased significantly over the past few years. According to data from the International Diabetes Federation (IDF), approximately 1.6 million people were using insulin pumps globally in 2019, with the majority of users in high-income countries. In the United States, data from the Centers for Disease Control and Prevention (CDC) shows that the use of insulin pumps has increased by nearly 50% in the past decade, with approximately 10% of people with diabetes using insulin pumps in 2020.

These statistics demonstrate the growing importance and popularity of insulin pumps as a tool for managing diabetes and highlight the need for ongoing research and development to improve their functionality and reliability.

IoT-based secure embedded schemes are designed to address the challenges of data acquisition and monitoring in insulin pumps. The proposed IoT-based secure embedded scheme for insulin pump data acquisition and monitoring aims to address the security and privacy concerns associated with transmitting sensitive medical information over the internet. The scheme may employ secure communication protocols, encryption algorithms, and access control mechanisms to ensure that only authorized parties can access and view the insulin pump data.

The goal of this research is to develop a secure and reliable data acquisition and monitoring system that can be integrated into insulin pumps, to provide patients and healthcare providers with real-time access to critical information about insulin usage and glucose levels. The results of this research could have important implications for improving the safety, efficiency, and effectiveness of insulin pump therapy for people with diabetes.

DESCRIPTION OF THE WORK

The amount of insulin dispensed by the pump can be controlled by interfacing with an **ARM Cortex M3 microcontroller.** The advantages of this are as follows:

1. **Energy Efficiency**: The Cortex-M3 is designed to be energy efficient, which is important for insulin pumps that need to be powered by small, portable batteries.
2. **Real-Time Performance:** The Cortex-M3 has real-time capabilities that make it well-suited for demanding applications like insulin pumps, where accurate and reliable delivery of insulin is essential.
3. **High Integration:** The Cortex-M3 integrates many of the components required for insulin pump operation, including memory, peripherals, and communication interfaces. This reduces the complexity of the system and makes it easier to develop and manufacture insulin pumps.
4. **Scalability:** The Cortex-M3 is scalable, which allows insulin pump manufacturers to create devices with different features and capabilities. This can help to meet the varying needs of different patient populations.
5. **Cost-Effective:** The Cortex-M3 is a cost-effective solution for insulin pump manufacturers, making it possible to create high-performance insulin pumps at a reasonable price.

Overall, the use of the ARM Cortex-M3 in insulin pumps can help to improve their performance, reliability, and accessibility, making them a more effective tool for people with diabetes to manage their condition.

DC motors are used in infusion pumps because they are efficient, reliable, and precise in controlling fluid flow rate. They are capable of producing high torque at low speeds, which is necessary for accurately dispensing fluids, and their compact size and low weight make them suitable for use in portable medical devices. Additionally, DC motors can be easily controlled and regulated through the use of electronic controllers, making them a good choice for use in infusion pumps where accuracy and consistency are critical.

The following code describes the interfacing of a DC motor to the LPC1768 board. The DC motor controls the amount of insulin dispensed by the pump.

CODE

```c
#include<LPC17xx.h>

void pwm_init(void);

void PWM1_IRQHandler(void);

unsigned long int i;

unsigned char flag,flag1;

int main(void)

{

            pwm_init();

            while(1);

}//end of main

void pwm_init(void)

{

            LPC_SC->PCONP=(1<<6);

            LPC_PINCON->PINSEL3=0X00020000;

            LPC_PWM1->PR=0X00000000;

            LPC_PWM1->PCR=0X0002000;

            LPC_PWM1->MCR=0X0000003;

            LPC_PWM1->MR0=60000;

            LPC_PWM1->MR5=0X00000100;

            LPC_PWM1->LER=0X000000FF;

            LPC_PWM1->TCR=0X00000002;
```

```
            LPC_PWM1->TCR=0X00000009;

            NVIC_EnableIRQ(PWM1_IRQn);

}

void PWM1_IRQHandler(void)

{

        LPC_PWM1->IR=0XFF;

        if(flag==0x00)

        {

                LPC_PWM1->MR5+=100;

                LPC_PWM1->LER=0X0000000FF;

                if(LPC_PWM1->MR5>=57000)

                        //for 10% of duty cycle MR5=3000, for 50% MR5=15000, for
90% MR5=27000

                        {

                                flag1=0xff;

                                flag=0xff;

                                LPC_PWM1->LER=0X000000FF;

                        }

                        for(i=0;i<8000;i++);

        }

        else if(flag1==0xff)

        {

                LPC_PWM1->MR5= 100;

                LPC_PWM1->LER=0X0000000FF;

                if(LPC_PWM1->MR5<=0X300)
```

```
                //1% OF duty cycle MR5=300

        {

                flag=0x00;

                flag1=0x00;

                LPC_PWM1->LER=0X000000FF;

        }

    for(i=0;i<8000;i++);

        }

    }
```

CODE FLOWCHART

```
                    ┌──────────────┐
                    │    Start     │
                    └──────┬───────┘
                           │
                    ┌──────▼───────┐
                    │    PWM1      │
                    │  is powered  │
                    └──────┬───────┘
                           │
              ┌────────────▼─────────────┐
              │ Select PWM5 single edge  │
              │  and PWM5 output is      │
              │       enabled            │
              └────────────┬─────────────┘
                           │
                    ┌──────▼───────┐
                    │ Setup match  │
                    │ register MR5 │
                    └──────┬───────┘
                           │
                    ┌──────▼───────┐
                    │ Reset counter│
                    │ and prescaler│
                    └──────┬───────┘
                           │
                    ┌──────▼───────┐
                    │ Turn the     │
                    │  motor on    │
                    └──────┬───────┘
                           │
         ┌─────────────────▼──────────────────┐
         │ Call a delay subroutine to hold    │
         │ the motor ON and set the speed     │
         │ for a specific duty cycle          │
         └─────────────────┬──────────────────┘
                           │
                      ◇────▼─────◇      No    ┌──────────────┐
                      if MR5>speed ──────────►│  No rotation │
                      ◇──────────◇            └──────┬───────┘
                           │ Yes                     │
                    ┌──────▼───────┐                 │
                    │ Rotate the   │                 │
                    │   motor      │                 │
                    └──────┬───────┘                 │
                           │                         │
                    ┌──────▼───────┐                 │
                    │ Wait for 8000│◄────────────────┘
                    │  iterations  │
                    └──────┬───────┘
                           │
                    ┌──────▼───────┐
                    │ Turn the     │
                    │  motor off   │
                    └──────┬───────┘
                           │
                    ┌──────▼───────┐
                    │     End      │
                    └──────────────┘
```
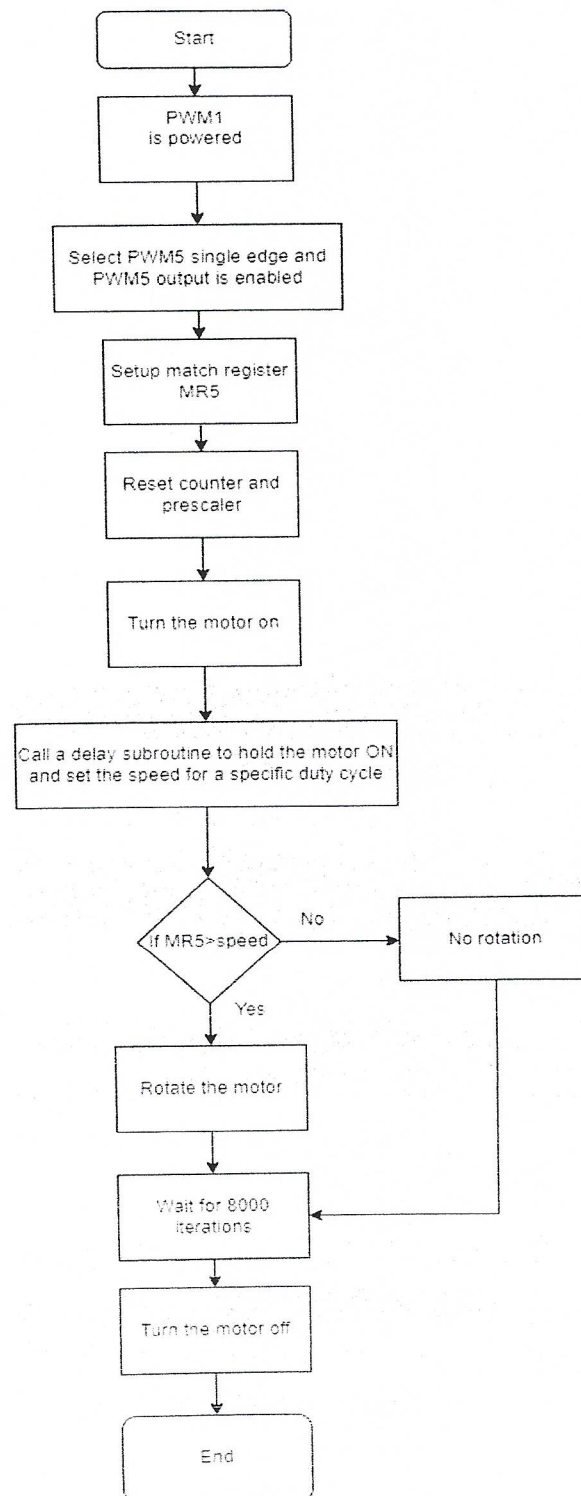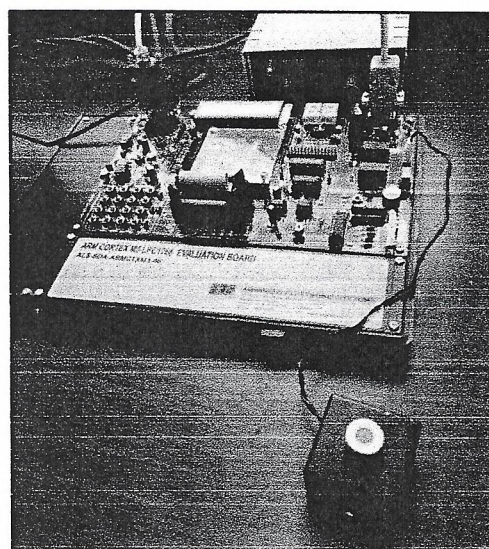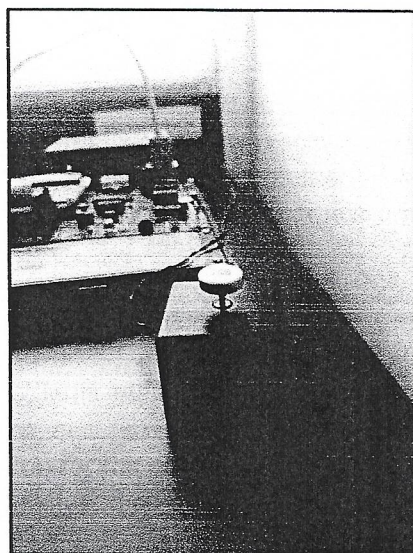
RESULT

The DC motor was made to rotate at different duty cycles. A slow speed is selected for the control of the insulin pump.

LEARNING OUTCOMES

PO	PROGRAMME OUTCOMES ADDRESSED	JUSTIFICATION
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	The team members referred to a variety of research papers based on insulin pumps and Arm processors to prepare this presentation and report.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	Concepts of programming and microcontrollers were applied to develop a solution for efficient delivery of insulin to a diabetic patient.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	A program was designed after referring to multiple research papers and statistics available.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and PO5 modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	Concepts of programming were implemented using Keil µVision 4 software and LPC1768 board.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	All the team members worked synchronously to create this presentation and report.

INDIVIDUAL CONTRIBUTION

Member	Contribution
Apoorva M S	Paper research, Report
Sakshi Marodia	Code modifications, Report
Vani S R	Code research, Report

REFERENCES

[1] Al-Odat, Zeyad & Srinivasan, Sudarshan & Al-Qtiemat, Eman & Dubasi, Mohana Asha Latha & Shuja, Sana. (2018). IoT-Based Secure Embedded Scheme for Insulin Pump Data Acquisition and Monitoring.

[2]S. Zavitsanou, A. Chakrabarty, E. Dassau, and F. Doyle, "Embedded control in wearable medical devices: Application to the artificial pancreas," *Processes*, vol. 4, no. 4, p. 35, 2016.

[3]Zhang Xin and Tang Jian, "Study of the constant speed control of motor for insulin pump based on optical encoder," *2011 International Conference on Electric Information and Control Engineering*, 2011.

[4]M. M. Abrar, "Interfacing a DC Motor with ARM Cortex M3 Microcontroller LPC1768," *International Journal for Research in Engineering Application & Management (IJREAM)*, vol. 04, no. 09, Dec. 2018.

B.M.S. College of Engineering, Bengaluru

Department of Medical Electronics Engineering

19ML5PE2BM - BIOMATERIALS

AAT Report

on

TOPIC: POLYANILINE WITH CURCUMIN

Submitted By

PRATHIKSHA HARISH - 1BM20MD035

KRITHIK RAJ K - 1BM20MD023

ABHINAV RAJKUMAR – 1BM20MD002

Academic Year 2022-23

Content

1. Introduction to Biomaterials:

- A biomaterial is a substance that has been created specifically to interact with biological systems for therapeutic or diagnostic purposes in medicine.
- Biomaterials has been a field of study for about fifty years. Biomaterials science or biomaterials engineering is the study of biomaterials.
- In the lab, biomaterials can be created using a number of chemical techniques using metallic or polymeric components, ceramics, or composite materials. Biomaterials can also be obtained from nature.
- They frequently serve and/or are modified for medical purposes, and as a result, they might be all or part of a living structure or biomedical device that replaces, augments, or performs a natural function.
- Such functionalities may be comparatively inactive, like those found in a heart valve, or they may be bioactive with a more interactive functionality, like those seen in hip implants covered in hydroxyapatite.

Turmeric can be used to create a biomaterial with the following properties:

1. Antioxidant and anti-inflammatory: Turmeric has natural antioxidants and anti-inflammatory properties, which can be beneficial in medical applications.

2. Biocompatibility: Turmeric has been found to be biocompatible, meaning it does not cause an adverse reaction when used in contact with living tissue.

3. Biodegradability: Turmeric is a natural, biodegradable material, which makes it a suitable candidate for use in biodegradable medical devices and implants.

4. Non-toxicity: Turmeric is generally considered non-toxic, making it safe for use in medical applications.

5. Mechanical strength: The mechanical strength of a turmeric-based biomaterial can vary depending on the processing and formulation, but in general, it has been found to have good mechanical properties, making it suitable for use in load-bearing applications.

6. Antimicrobial properties: Turmeric has been shown to have antimicrobial properties, making it a potential candidate for use in medical devices to prevent infection.

7. Surface chemistry: The surface chemistry of a turmeric-based biomaterial can be tailored to improve its performance and interaction with living tissues.

INTRODUCTION TO POLYANILINE :

Materials containing polyaniline (PANI) have a wide range of recognised uses in a variety of industries, including electrical and electrochemical devices, electrochemically active membranes, and stimuli-responsive systems. The majority of interest in the field of developing biomaterials for tissue engineering and medication delivery systems has been drawn to these materials. PANI has outstanding qualities such simplicity in synthesis, high electrical conductivity, particularly in the doped condition, ease of modification to increase water processability, and improved biocompatibility. In the procedure known as electrical stimulation (ES), cells cultivated on the produced biomaterial can be electrically stimulated, an engineered PANI-based biomaterial can be used. The ES modifies cellular behaviour and imitates the natural function of bioelectricity.

2. Description of the work and results

A blend of Turmeric and Polyaniline.

Curcumin

INTRODUCTION

Nanofibrous substrate consisting of turmeric and polyaniline nanoparticles that exhibit topological and biological features that mimic the natural extracellular matrix for nerve cells.

We evaluated the morphology of 2-dimensional fibrous substrates, and their ability of stem cell adhesion, growth and proliferation rate was influenced by the use of various concentrations of turmeric in substrates.

INTRODUCTION TO SEM CHARACTERIZATION :

Scanning Electron Microscopy (SEM) is a type of electron microscopy that uses a beam of electrons to produce high-resolution images of the surface of a sample. SEM can be used to characterize the morphological features of a sample, such as size, shape, and distribution of particles.

When turmeric is mixed with polyaniline, the SEM images can reveal the distribution and interaction between the turmeric and polyaniline particles. The images can also provide information on the surface characteristics, such as roughness, porosity, and homogeneity, of the sample. Additionally, SEM can be used to examine the effect of the mixture on the electrical conductivity and electroactivity of the sample, which can be important in applications such as energy storage and sensors.

RESULTS

The results showed that 0.62 wt% of Turmeric and 0.28 wt% of nanoparticles in nanofibers substrate exhibited the optimal cellular microenvironment to accelerate cellular activities, It also showed that substrate significantly stimulated the proliferation, differentiation, and spontaneous outgrowth and extension of neurites from the cells.

SEM characterization was done to the sample and the following image was obtained with the below inference:

- No rod like structures were found.
- It is distributed uniformly in the composite substrate as compared to pure nanoparticle substrates, due to the strong cytocompatibility of Turmeric.
- The compound shows plate like formation , but under further magnification we can clearly observe more distinctively.

3. Learning Outcomes

1. Understanding of the basic concepts and principles of biomaterials science, including their definition, classification, and properties.

2. Awareness of the factors that influence the performance of biomaterials, such as biocompatibility, biodegradability, and mechanical properties.

3. Familiarity with the fabrication techniques and processing methods used to produce biomaterials.

4. Familiarity with SEM Characterization and the procedure followed while preparing a Material for SEM Characterization.

5. Understanding of the testing and evaluation methods used to assess the performance of biomaterials post SEM Characterization.

6. Ability to critically analyze and evaluate the potential benefits and limitations of different biomaterials for various applications in medicine and biology.

7. Awareness of current trends and developments in biomaterials research and their potential impact on future medical and biological applications.

8. Knowledge of the regulatory and ethical considerations involved in the development and use of biomaterials, including intellectual property, safety, and clinical trials.

4. Individual Contribution

Krithik:

- The ideal turmeric root was chosen for the sample. For the root to be adequately ground, it was sun-dried for a few days.
- The root was thoroughly ground into a fine powder, it was then prepared to be combined with *Polyaniline*.

Prathiksha:

- The fine turmeric powder was then brought to the lab to be blended with Polyaniline thoroughly using *Mortar and Pestle*.
- Then the sample was collected using a spatula into a small plastic ait-tight container.
- The mixture was then taken into the *SEM Characterization lab* for observation.

B.M.S. College of Engineering, Bengaluru

Department of Medical Electronics Engineering

19ML5PE2BM - BIOMATERIALS

AAT Report

on

TOPIC: POLYANILINE WITH CURCUMIN

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Academic Year 2022-23

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4. Non-toxicity: Turmeric is generally considered non-toxic, making it safe for use in medical applications.

5. Mechanical strength: The mechanical strength of a turmeric-based biomaterial can vary depending on the processing and formulation, but in general, it has been found to have good mechanical properties, making it suitable for use in load-bearing applications.
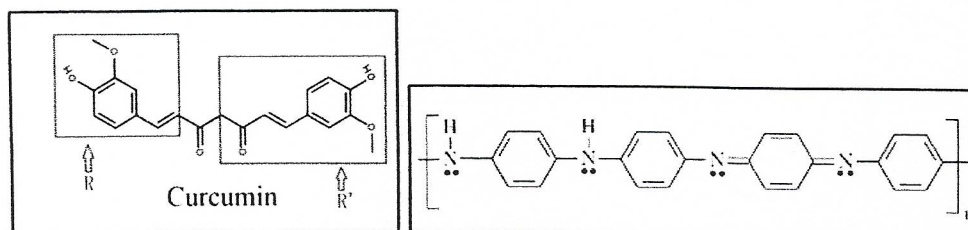
6. Antimicrobial properties: Turmeric has been shown to have antimicrobial properties, making it a potential candidate for use in medical devices to prevent infection.

7. Surface chemistry: The surface chemistry of a turmeric-based biomaterial can be tailored to improve its performance and interaction with living tissues.

INTRODUCTION TO POLYANILINE :

Materials containing polyaniline (PANI) have a wide range of recognised uses in a variety of industries, including electrical and electrochemical devices, electrochemically active membranes, and stimuli-responsive systems. The majority of interest in the field of developing biomaterials for tissue engineering and medication delivery systems has been drawn to these materials. PANI has outstanding qualities such simplicity in synthesis, high electrical conductivity, particularly in the doped condition, ease of modification to increase water processability, and improved biocompatibility. In the procedure known as electrical stimulation (ES), cells cultivated on the produced biomaterial can be electrically stimulated, an engineered PANI-based biomaterial can be used. The ES modifies cellular behaviour and imitates the natural function of bioelectricity.

2. Description of the work and results

A blend of Turmeric and Polyaniline.

Curcumin

INTRODUCTION

Nanofibrous substrate consisting of turmeric and polyaniline nanoparticles that exhibit topological and biological features that mimic the natural extracellular matrix for nerve cells.

We evaluated the morphology of 2-dimensional fibrous substrates, and their ability of stem cell adhesion, growth and proliferation rate was influenced by the use of various concentrations of turmeric in substrates.

INTRODUCTION TO SEM CHARACTERIZATION :

Scanning Electron Microscopy (SEM) is a type of electron microscopy that uses a beam of electrons to produce high-resolution images of the surface of a sample. SEM can be used to characterize the morphological features of a sample, such as size, shape, and distribution of particles.

When turmeric is mixed with polyaniline, the SEM images can reveal the distribution and interaction between the turmeric and polyaniline particles. The images can also provide information on the surface characteristics, such as roughness, porosity, and homogeneity, of the sample. Additionally, SEM can be used to examine the effect of the mixture on the electrical conductivity and electroactivity of the sample, which can be important in applications such as energy storage and sensors.

RESULTS

The results showed that 0.62 wt% of Turmeric and 0.28 wt% of nanoparticles in nanofibers substrate exhibited the optimal cellular microenvironment to accelerate cellular activities, It also showed that substrate significantly stimulated the proliferation, differentiation, and spontaneous outgrowth and extension of neurites from the cells.

SEM characterization was done to the sample and the following image was obtained with the below inference:

- No rod like structures were found.
- It is distributed uniformly in the composite substrate as compared to pure nanoparticle substrates, due to the strong cytocompatibility of Turmeric.
- The compound shows plate like formation , but under further magnification we can clearly observe more distinctively.

3. Learning Outcomes

1. Understanding of the basic concepts and principles of biomaterials science, including their definition, classification, and properties.

2. Awareness of the factors that influence the performance of biomaterials, such as biocompatibility, biodegradability, and mechanical properties.

3. Familiarity with the fabrication techniques and processing methods used to produce biomaterials.

4. Familiarity with SEM Characterization and the procedure followed while preparing a Material for SEM Characterization.

5. Understanding of the testing and evaluation methods used to assess the performance of biomaterials post SEM Characterization.

6. Ability to critically analyze and evaluate the potential benefits and limitations of different biomaterials for various applications in medicine and biology.

7. Awareness of current trends and developments in biomaterials research and their potential impact on future medical and biological applications.

8. Knowledge of the regulatory and ethical considerations involved in the development and use of biomaterials, including intellectual property, safety, and clinical trials.

B.M.S. College of Engineering, Bengaluru

Department of Medical Electronics Engineering

19ML5PE2BM - BIOMATERIALS

AAT Report

on

TOPIC: POLYANILINE WITH CURCUMIN

Submitted By

PRATHIKSHA HARISH - 1BM20MD035

KRITHIK RAJ K - 1BM20MD023

ABHINAV RAJKUMAR – 1BM20MD002

Academic Year 2022-23

Content

1. Introduction to Biomaterials:

- A biomaterial is a substance that has been created specifically to interact with biological systems for therapeutic or diagnostic purposes in medicine.
- Biomaterials has been a field of study for about fifty years. Biomaterials science or biomaterials engineering is the study of biomaterials.
- In the lab, biomaterials can be created using a number of chemical techniques using metallic or polymeric components, ceramics, or composite materials. Biomaterials can also be obtained from nature.
- They frequently serve and/or are modified for medical purposes, and as a result, they might be all or part of a living structure or biomedical device that replaces, augments, or performs a natural function.
- Such functionalities may be comparatively inactive, like those found in a heart valve, or they may be bioactive with a more interactive functionality, like those seen in hip implants covered in hydroxyapatite.

Turmeric can be used to create a biomaterial with the following properties:

1. Antioxidant and anti-inflammatory: Turmeric has natural antioxidants and anti-inflammatory properties, which can be beneficial in medical applications.

2. Biocompatibility: Turmeric has been found to be biocompatible, meaning it does not cause an adverse reaction when used in contact with living tissue.

3. Biodegradability: Turmeric is a natural, biodegradable material, which makes it a suitable candidate for use in biodegradable medical devices and implants.

4. Non-toxicity: Turmeric is generally considered non-toxic, making it safe for use in medical applications.

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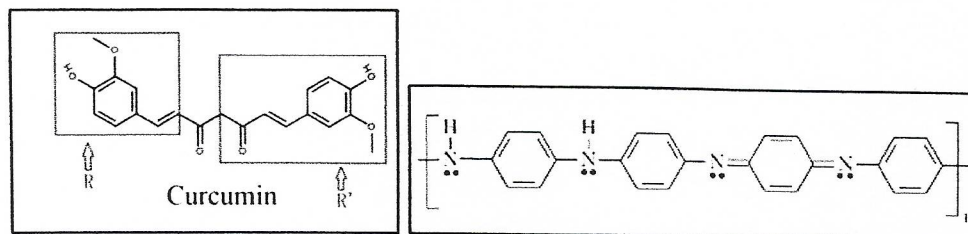
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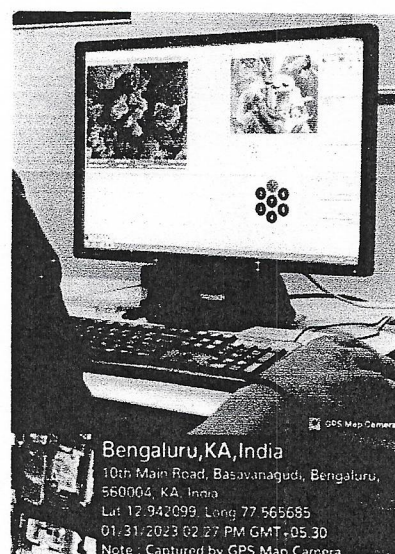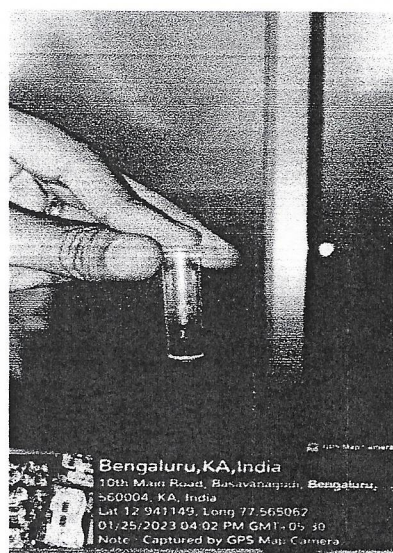
4. Individual Contribution

Krithik:

- The ideal turmeric root was chosen for the sample. For the root to be adequately ground, it was sun-dried for a few days.
- The root was thoroughly ground into a fine powder, it was then prepared to be combined with *Polyaniline*.

Bengaluru,KA,India
Haveri Pipeline Road, Kumaraswamy Layout,
Bengaluru, 560111, KA, India
Lat 12.941261, Long 77.565028
01/25/2023 03:49 PM GMT+05:30
Note : Captured by GPS Map Camera

Prathiksha:

- The fine turmeric powder was then brought to the lab to be blended with Polyaniline thoroughly using *Mortar and Pestle.*
- Then the sample was collected using a spatula into a small plastic ait-tight container.
- The mixture was then taken into the *SEM Characterization lab* for observation.

Bengaluru,KA,India
10th Main Road, Basavanagudi, Bengaluru,
560004, KA, India
Lat 12.942099, Long 77.565685
01/31/2023 02:27 PM GMT+05:30
Note : Captured by GPS Map Camera

Bengaluru,KA,India
10th Main Road, Basavanagudi, Bengaluru,
560004, KA, India
Lat 12.941149, Long 77.565062
01/25/2023 04:02 PM GMT+05:30
Note : Captured by GPS Map Camera

Abhinav:

- Co-ordination with the team members – integrating the complete report.
- Researched the reference papers on multiple sources for in-depth analysis of the objective.
- Consolidated the data and composed the final report.

5. References

- Engineering 2D approaches fibrous platform incorporating turmeric and polyaniline nanoparticles to predict the expression of βIII-Tubulin and TREK-1 through qRT-PCR to detect neuronal differentiation of PC12 cells.
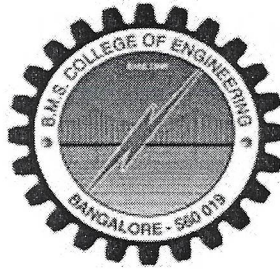 *-Sita Shrestha, Se Rim Jang, Bishnu Kumar Shrestha, Chan Hee Park, Cheol Sang Kim*

- *https://www.ncbi.nlm.nih.gov/books/NBK92752/*
  -Sahdeo Prasad and Bharat B. Aggarwal.

  https://www.sciencedirect.com/science/article/pii/B9780128179154000014
  Narendra Pal Singh Chauhan , Masoud Mozafari

BMS COLLEGE OF ENGINEERING

BULL TEMPLE ROAD, BANGALORE-560019.

DEPARTMENT OF MEDICAL ELECTRONICS

VI SEMESTER (2021-2022)

Biomedical Signal Processing

AAT-REPORT

Topic – Cochlear Implant Simulation On MATLAB

NAME	USN
ANKITH HAVALDAR	1BM19ML009
GANICA SB	1BM19ML014
LISHA TEJ T	1BM19ML023
MONESH G	1BM19ML029

FACULTY INCHARGE- Dr. R Kalpana

Dr. K Vijayalakshmi

ABSTRACT

The cochlear implant is the most successful of all neural prostheses developed to date. It is the most effective prosthesis in terms of restoration of function, and the people who have received a cochlear implant outnumber the recipients of other types of neural prostheses by orders of magnitude. The primary purpose of this article is to provide an overview of contemporary cochlear implants from the perspective of two designers of implant systems. That perspective includes the anatomical situation presented by the deaf cochlea and how the different parts of an implant system (including the user's brain) must work together to produce the best results. In particular, we present the design considerations just mentioned and then describe in detail how the current levels of performance have been achieved. We also describe two recent advances in implant design and performance. In concluding sections, we first present strengths and limitations of present systems and then offer some possibilities for further improvements in this technology. In all, remarkable progress has been made in the development of cochlear implants but much room still remains for improvements, especially for patients presently at the low end of the performance spectrum.

INTRODUCTION

Cochlear implants are among the great success stories of modern medicine. Thirty years ago these devices provided little more than a sensation of sound and sound cadences—they were useful as an aid to lip-reading. In the 1980s, however, systems with multiple channels of processing and multiple sites of stimulation in the cochlea were developed and these systems supported significantly higher levels of speech reception than their single-channel and single-site predecessors. In the late 1980s and continuing to the present, new and better processing strategies, in conjunction with multi electrode implants, have produced further large improvements. Indeed, a principal conclusion of the 1995 National Institutes of Health (NIH) Consensus Conference on Cochlear Implants in Adults and Children [1] was that "A majority of those individuals with the latest speech processors for their implants will score above 80 percent correct on high context sentences, even without visual cues." This level of performance is remarkable and is far greater than that achieved to date with any other type of neural prosthesis.

PURPOSE:

The purpose for my project is to find out more about the Cochlear Implant. I want to know what the negative things are about the Cochlear Implant that made my mom take five months to make the decision to go ahead with the operation. I also want to know how the Cochlear Implant works and how it is implanted in the

New technology has brought the cochlear implant. The cochlear implant does not amplify sound. It bypasses the missing or damaged hair cells altogether, and delivers more sound information directly to the hearing nerve.

The cochlear implant has two parts:

1) The implant, which is surgically placed into the Mastoid bone,

2) The outer device of a headpiece and processor.

The actual surgery generally takes two or three hours and is carried out under general anaesthesia. During this time, the surgeon makes a space on the surface of the bone behind the ear to hold the implant and carefully inserts the electrode array into the inner ear. After allowing one month for the healing process of the surgery, you are fitted with the sound processor and headpiece that enables you to hear.

COMPONENTS OF COCHLEAR IMPLANT SYSTEMS

The essential components in a cochlear prosthesis system are illustrated in Figure and include
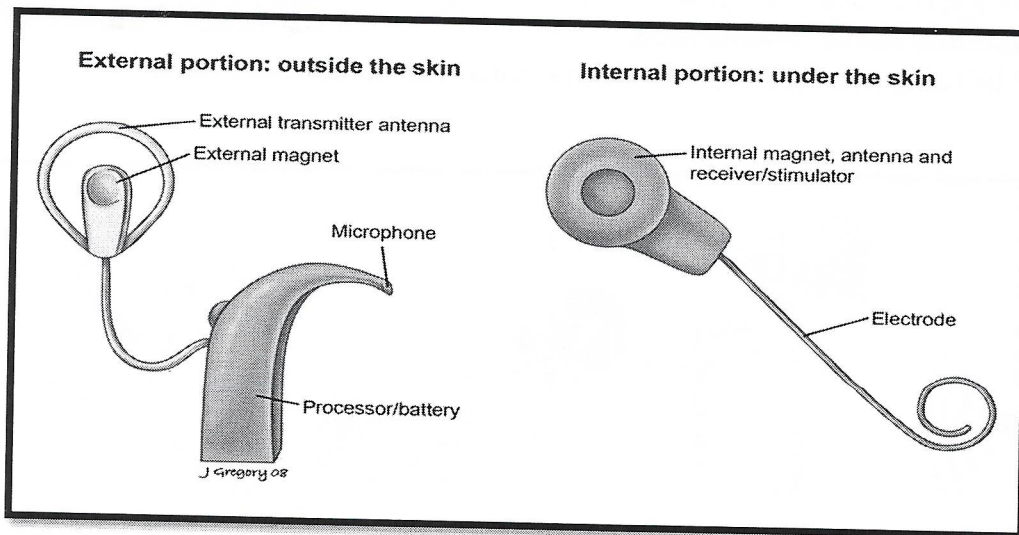
1. A microphone for sensing sound in the environment
2. A speech processor to transform the microphone input into a set of stimuli for the implanted array of electrodes
3. A transcutaneous link for the transmission of power and stimulus information across the skin
4. An implanted receiver/ stimulator to decode the information received from the radio frequency signal produced by an external transmitting coil and

There are six things that we need to remember once we have been implanted and they are:

1. Placement of the implant electrode into the cochlea will destroy any residual hearing in the implanted ear. You will never be able to hear anything in the implanted ear without the use of the cochlear implant.

2. You will never be able to undergo Magnetic Resonance Imaging (MRI), which is a special diagnostic test similar to an X-ray.

3. If you have surgery in the future, the surgeons will need to know that they can only use the Monopolar Electro cautery device in areas below the shoulder blades and the Bipolar cautery instrument needs to maintain a 2 cm margin around the implant device. An Electro cautery is a device used by surgeons to control blood loss during an operation.

4. It is recommended that one does not play any contact sports (football, wrestling, karate, etc.). A helmet should ALWAYS be worn during activities that may result in a fall or inadvertent injury to the implant site. Each user and his/her family must decide the level of risk that is acceptable in terms of activities that are permitted.

5. The implant will activate metal detectors, which may be a nuisance to you at airports and other security checkpoints. Cell phones and other electronic devices may rarely interfere with the implant performance.

6. You should avoid activities in which static electricity is commonly created (plastic slides on playgrounds, removing a wool sweater, etc.).

7. Don't forget that during some activities you will still be deaf. Due to the fact That the processor is not waterproof or submersible, you will be deaf when bathing, showering or swimming.

THE BLOCK DIAGRAM

Cochlear implant speech processor, from the microphone which picks up the sound (Input Source block) to the electrical pulses that are generated. The frequencies increase in pitch from Channel 0, which transmits the lowest frequency, to Channel 7, which transmits the highest.

To hear the original input signal, double-click the Original Signal block at the bottom of the model. To hear the output signal of the simulated cochlear implant, double-click the Reconstructed Signal block.

There are a number of changes you can make to the model to see how different variables affect the output of the cochlear implant speech processor. Remember that after you make a change, you must rerun the model to implement the changes before you listen to the reconstructed signal again.

particularly essential for the fixed-point version of this example. The eight filters are running in parallel at the input signal rate. You can look at their frequency responses by double clicking the **Plot IIR Filter Bank Response** button.

Cascaded MultiMate Multistage FIR Filter Bank: The design of this filter bank is based on the principles of an approach that combines down sampling and filtering at each filter stage. The overall filter response for each sub band is obtained by cascading its components. Double click on the **Design Filter Banks** button to examine how design functions from the DSP System Toolbox are used in constructing these filter banks.

Consequently, this design is very suitable for implementations on the low-power DSPs with limited processing cycles that are used in cochlear implant speech processors. You can look at the frequency responses for this filter bank by double clicking on the **Plot FIR Filter Bank Response** button.

MATLAB simulation:
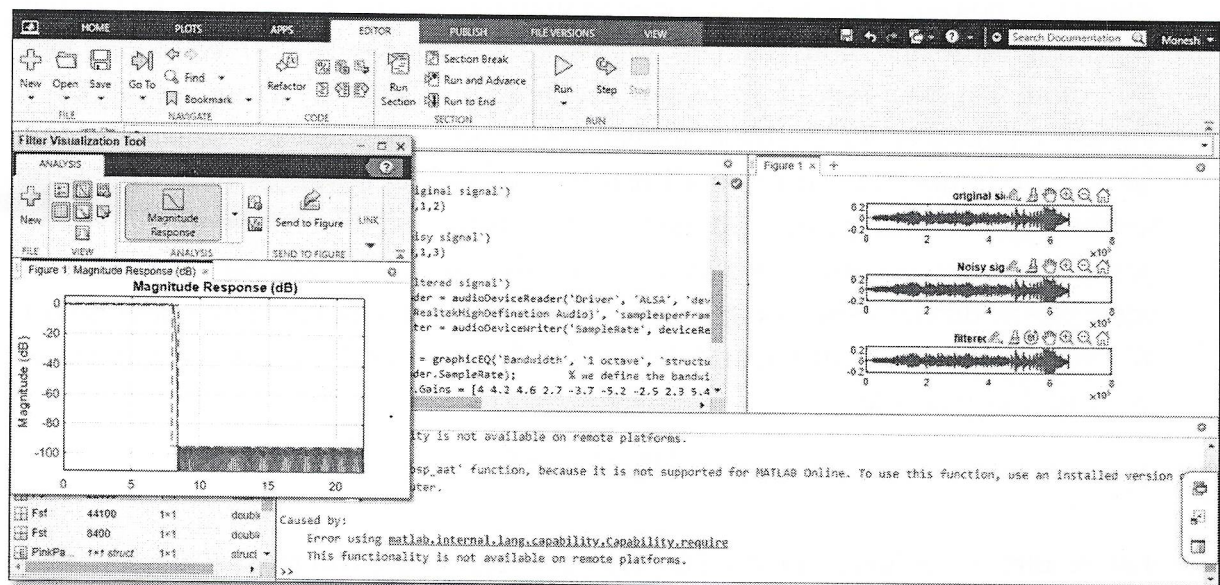
INVISIBLE HEARING – FULLY IMPLANTABLE COCHLEA IMPLANT SYSTEMS

Advances in battery and microphone technology allowed fully implantable hearing systems. The energy supply is performed by transcutaneous charged batteries. The sound reception occurs transcutaneous. If needed, an external speech processor can be coupled. Currently battery lifetimes of about 10–15 years are considered as being realistic. The patient gains further freedom of action and loses the stigma of disability. One disadvantage-age is the restriction to software

REFERENCES

1. National Institutes of Health Consensus Conference. Cochlear implants in adults and children. JAMA. 1995; 274(24):1955–61. [PMID: 8568992]
2. Eisen MD. History of the cochlear implant. In: Waltzman SB, Roland JT Jr, editors. Cochlear implants. 2nd ed. New York (NY): Thieme; 2006. p. 1–10.
3. Finn R, Hudspeth AJ, Zwislocki J, Young E, Merzenich M. Sound from silence: The development of cochlear implants. In: Beyond discovery: The path from research to human benefit. Washington (DC): National Academy of Sciences; 1999. p. 1–8.
4. Niparko JK, Wilson BS. History of cochlear implants. In: Niparko JK, Kirk KI, Mellon NK, Robbins AM, Tucci DL, Wilson BS, editors. Cochlear implants: Principles & practices. Philadelphia (PA): Lippincott Williams & Wilkins; 2000. p. 103–8.
5. Wilson BS, Dorman MF. Interfacing sensors with the nervous system: Lessons from the development and success of the cochlear implant. IEEE Sensors J. 2008;8(1):131–47.
6. Hinojosa R, Marion M. Histopathology of profound sensorineural deafness. Ann N Y Acad Sci. 1983;405:459–84.

----- THANKYOU -----

C Programs

CODE:

```c
#include<stdio.h>
#include<conio.h>
#include<graphics.h>
#include<math.h>

main()
{
float x[400]={0},y[400]={0};
int i;
int gd=DETECT,gm;
FILE *file;
initgraph(&gd,&gm,"c:\\tc\\bgi");
file=fopen("c:\\tc\\bin\\ecgs1.dat","r");
moveto(10,150);

for(i=0;i<400;i++)
     {
            fscanf(file,"%f",&x[i]);
            lineto(10+i,150-x[i]/2);
     }
outtextxy(200,200,"Original ecg signal");

y[0]=0,y[1]=0;
moveto(10,350);

for(i=3;i<400;i++)
     {
            y[i]=(x[i]+2*x[i-1]+x[i-2])/4;
            lineto(10+i,350-y[i]/2);
     }
outtextxy(200,400,"Filtered ecg");
getch();
closegraph();

fclose(file);
return(0);
```
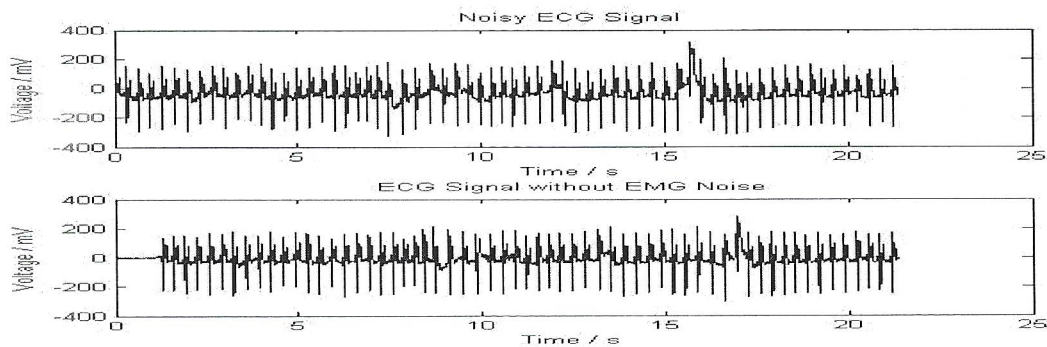
OUTPUT:

CODE:

```c
#include<stdio.h>
#include<conio.h>
#include<graphics.h>
#include<math.h>

main()
{

float x[600]={0}, y[600]={0},b1,b2,r=0.5;
int i,fc;
int gd=DETECT,gm;

FILE *file;
initgraph(&gd,&gm,"c:\\tc\\bgi");

file=fopen("c:\\tc\\bin\\ecgs1.dat","r");
printf("Enter the cut-off freq : ");
scanf("%d",&fc);
setcolor(BLUE);
setbkcolor(WHITE);

outtextxy(150,10,"OUTPUT : LPF");
b1=2*r*cos(2*3.1412*fc/180);
b2=r*r;
moveto(150,100);

for(i=0;i<200;i++)
     {
            fscanf(file,"%f",&x[i]);
            lineto(150+i,100-x[i]/5);
     }
outtextxy(150,150,"ORIGINAL ECG DATA");

y[0]=0,y[1]=0;
moveto(150,250);

//LPF filter function

for (i=2;i<200;i++)
     {
            y[i]=x[i]+2*x[i-1]+x[i-2]+b1*y[i-1]-b2*y[i-2];
            lineto(150+i,250-y[i]/10);
     }
outtextxy(150,350,"FILTERED ECG DATA");

getch();
closegraph();
return(0); }
```

PROGRAM NO 3:

AIM : Realization of Notch filter for removal of line interference.

THEORY:

Notch filters are also used in controllers. Where low-pass filters attenuate all signals above a specified frequency, notch filters remove only a narrow band of frequencies.Notch filters pass the frequency components below and above the notch frequency. The fact that notch filters pass high frequencies leads to their strongest attribute. Notch filters can be useful on the command for a fixed-frequency noise source such as that from line frequency (50 or 60 Hz) noise. Notch filters are also used to remove resonances from the system. Both notch and low-pass filters can cure resonance; notch filters do so while creating less phase lag in the control loop.

ALGORITHM:

1. ECG data is obtained.
2. Noise signal is obtained
3. The original ecg and the noise signal are combined.
4. Notch filter is implemented.
5. The original ecg,ecg and the noise signal combined signal and the filtered ecg is plotted.

CODE:

```
#include<stdio.h>
#include<conio.h>
#include<graphics.h>
#include<math.h>
main()
{
float x[400]={0},y[400]={0},z[400]={0},b1,b2,a1,r=0.5;
int i,fc=60;
int gd=DETECT,gm;


FILE *file;
```
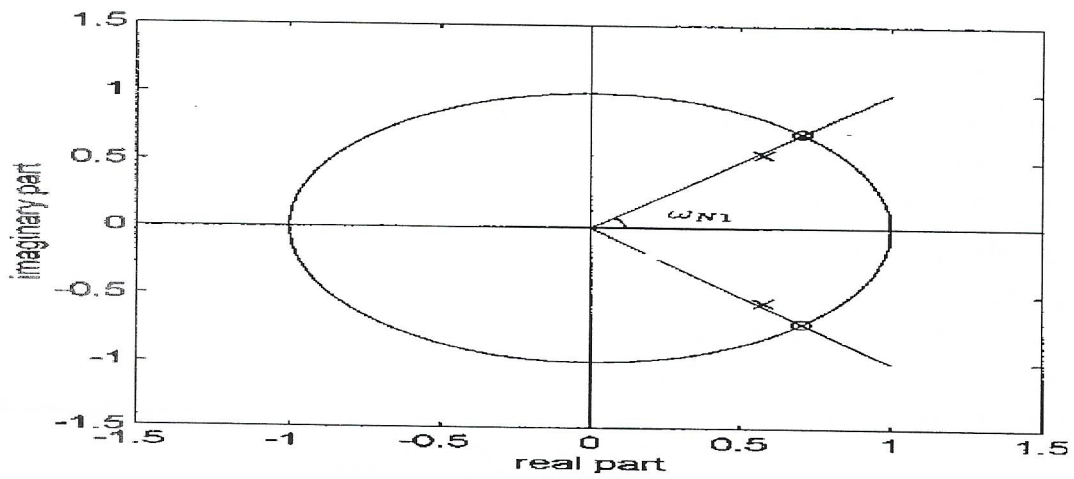
7

```
        outtextxy(200,440,"filtered ecg");

        getch();

        closegraph();

        return 0;

}
```

OUTPUT:
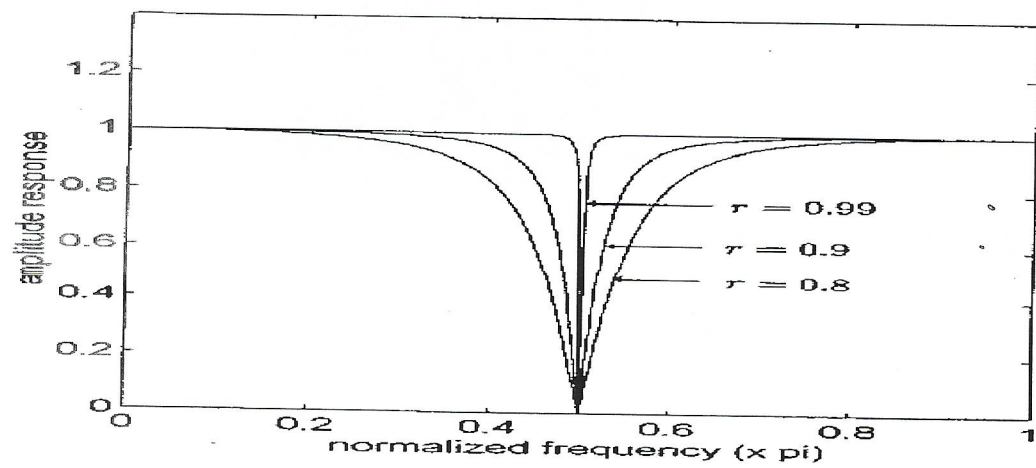
CODE:

```c
#include<stdio.h>
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#include<math.h>

main()
{
    float x[400]={0}, y[400]={0},b1,b2,r=0.5;
    int i,fc;
    int gd=DETECT,gm;

    FILE *file;
    initgraph(&gd,&gm,"c:\\tc\\bgi");
    file=fopen("ecgs1.dat","r");
    printf("enter the cut off frequency");
    scanf("%d",&fc);
    b1=2*r*cos(2*3.1412*fc/180);
    b2=r*r;
    moveto(10,150);
    for(i=0;i<400;i++)
    { fscanf(file,"%f",&x[i]);
      lineto(10+i,150-x[i]/5);
    }
    outtextxy(200,190,"orig ecg sig");
    y[0]=0;y[1]=0;
    moveto(10,350);

    for(i=2;i<400;i++)
    { y[i]=x[i]-2*x[i-1]+x[i-2]+b1*y[i-1]-b2*y[i-2];
      lineto(10+i,350-y[i]/5);
    }
```

PROGRAM NO: 5

AIM: Generate a sine wave with 60Hz power line noise.

THEORY:

Magnitude response: It is the ratio of the amplitude of frequencies in the output signal

to the amplitude of frequencies of the input signal. It is used to describe how a system

impacts the amplitudes of frequencies in a signal.

Frequency response: It describes the steady-state response of a system to sinusoidal

inputs of varying frequencies and let's control engineers analyze and design control

systems in the frequency domain.

ALGORITHM :

1. After obtaining the ECG signal, time step of the data ie; elapsed time between first

and second data is found.

2. After finding the length of the signal, a noise signal is generated using a time step and a signal is generated.

```c
for(i=0;i<size;i++)
{   y[i]=x[i];
    lineto(10+i,150-y[i]/5);
}


outtextxy(100,60,"original signal");
y[0]=0;y[1]=0;


moveto(10,260);


for(i=3;i<size;i++)
{ z[i]=5*sin(2*3.1412*i*60/180);
  z[i]+=x[i];
  lineto(10+i,260-z[i]/5);
}


outtextxy(100,200,"ecg with 60hz noise");
moveto(10,400);


for(i=3;i<size;i++)
{
y[i]=(-3*x[i]+12*x[i-1]+17*x[i-2]+12*x[i-3]+3*x[i-4])/35;
lineto(10+i,400-y[i]/5);
}
outtextxy(100,320,"fil ecg sig");
getch();
closegraph();
return(0);
}
```
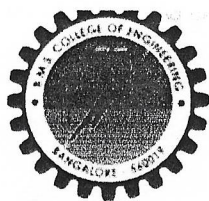
BMS COLLEGE OF ENGINEERING

(Autonomous under vtu, belgaum)

ALTERNATE ASSESSMENT TOOL

FACULTY INCHARGE:BEENA ULLALA MATA

COURSE NAME: PHYSIOLOGICAL CONTROL SYSTEM

COURSE CODE:19ML4PCPCS

PROJECT DONE BY:

SURAKSHA V	1BM20MD049
KUSUMA H N.	1BM20MD024
J THRISHAA.	1BM20MD019

12/7/2023

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ACKNOWLEDGEMENT

I would like to acknowledge one and all who hav put in efforts to complete this project successfully . I would like to express my special gratitude to our professor Beena ma'am who guided us in a best way in this course for the entire semester . We are also grateful because we managed to complete the given project within the given time. This assignment would not have been completed without the efforts and mutual coordination of our group members who researched and solved the problems we chose.

Last but not the least I would like to thank our friends and few others who sincerely helped us to get the project done .

INTRODUCTION

A control system may be defined as a collection of interconnected components that can be made to achieve a desired response in face of

External disturbance. The desired response could be the tracking of a specified dynamic trajectory, in which case the control system takes the form of servomechanism.

-

In open loop mode , the response of system is determined only by controlling inputs. They can perform satisfactorily as long as external conditions do not affect the system much.

-

In closed loop mode, it allows the system to be self regulatory, due to feedback mechanism. Weiner "a method of controlling a system by reinserting into it, the results of its past performance. This strategy of control is ubiquitous throughout nature.

Root Locus.

Q) $G(s) H(s) = \dfrac{k}{s(s+5)(s+10)}$, assume $k=1$

i) **Poles** :—

Poles $= 0, -5$ and -10

ii) **Zeros** :—

No zeros

iii) **No. of branches**

$P - Z = 3 - 0 = 3$

iv) **Angle asymptotes**

$$\phi = \dfrac{(2q+1)\,180^\circ}{P-Z}$$

$q, 0, 1, 2$

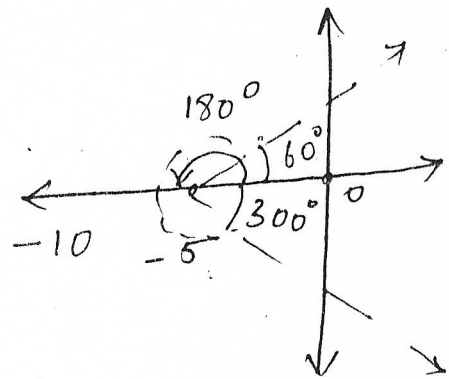$$\phi_1 = \dfrac{180^\circ}{3} = 60^\circ$$

$$\phi_2 = \dfrac{3 \times 180^\circ}{3} = 180^\circ$$

$$\phi_3 = \dfrac{5 \times 180^\circ}{3} = 300^\circ$$

v) **Centeroid**

$$G = \dfrac{\Sigma poles - \Sigma zeros}{P-Z}$$

$$\Rightarrow G = \dfrac{0 - 5 - 10}{2} = -5$$

vi) Finding breakaway point :-

$$1 + GH(s) = s(s+5)(s+10) + k = 0$$

$$k = -s^3 - 15s^2 - 50s$$

$$\frac{dk}{ds} = -3s^2 - 30s - 50 = 0$$

$$s^2 + 10s + 16.67 = 0$$

$$\Rightarrow \quad s = -2.113, \; -7.88$$

$$s = -2.113 \text{ is the breakaway point}$$

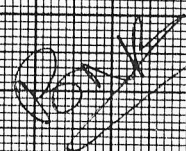vii) Finding intersection with the imaginary axis.

$$s^3 + 15s^2 + 50s + k = 0$$

$$
\begin{array}{c|cc}
s^3 & 1 & 50 \\
s^2 & 15 & k \\
s^1 & 750 - k/k & 0 \\
s^0 & k &
\end{array}
$$

$$750 - k = 0$$

$$k = 750$$

$$15s^2 + k = 0$$

$$s = j7.071 \text{ and } -j7.071.$$

HOME PLOTS APPS FIGURE TOOLS

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Line Color Line Style

TEXT STYLE LINE STYLE

Title X-Label Y-Label

LABELS AND ANNOTATIONS

Grid Format

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> MATLAB Drive >

Current Folder

Name ▲
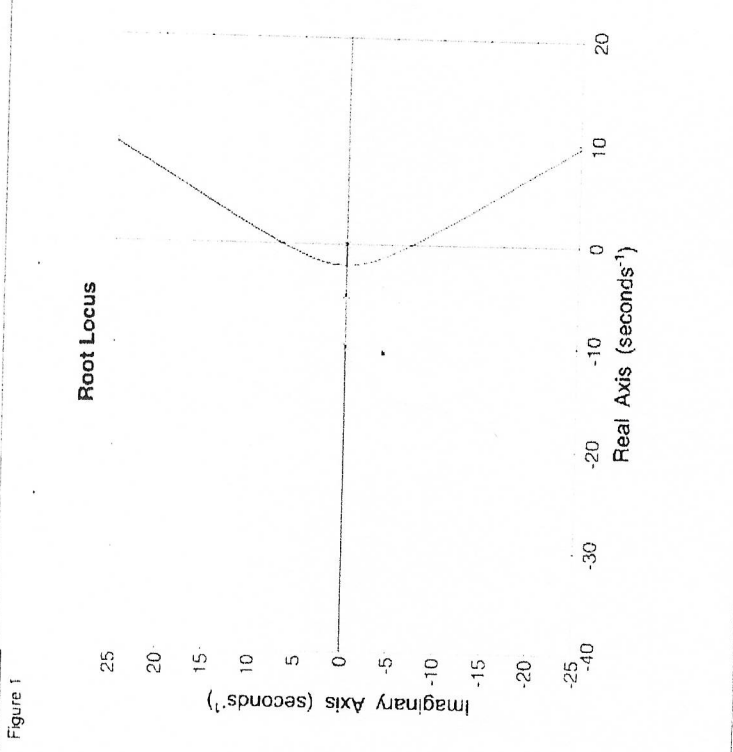- Published (my site)
- ECAAAT.slx
- rlocus.m
- roottocus.pdf
- time analysis.m
- timeanalysis.m

timeanalysis.m   rlocus.m

```
1   num = [1]
2   den = [1 15 50 0]
3   sys = tf(num, den)
4   rlocus(sys)
```

Workspace

Name	Value	Size	Class
ans	1×1 struct	1×1	struct
den	[1,15,50,0]	1×4	double
num	1	1×1	double
sys	1×1 tf	1×1	tf

Command Window

```
1   15   50   0

sys =

         1
  ---------------------
  s^3 + 15 s^2 + 50 s

Continuous-time transfer function.

>>
```

Figure 1

Root Locus

Real Axis (seconds⁻¹)

Imaginary Axis (seconds⁻¹)

① The transfer function of a given second order system

ie $\dfrac{C(s)}{R(s)} = \dfrac{36}{s^2 + 6s + 36}$ ⟶ Find the time domain

specification for the given system.

⟶ The transfer function of the given system.

$$\dfrac{C(s)}{R(s)} = \dfrac{36}{s^2 + 6s + 36} \longrightarrow ①$$

The standard function of a second order system is given

by $\dfrac{C(s)}{R(s)} = \dfrac{Wn^2}{s^2 + 2jw_ns + Wn^2} \longrightarrow ②$

Wn is the freqnency of osullations

  $J \longrightarrow$ damping factor

when we compone eq ① and ②

$Wn^2 = 36 \implies Wn = \sqrt{36} = 6 \text{ rads/sec}$

$2Jwn = 6$

$J = \dfrac{6}{2wn} = \dfrac{6}{2 \times 6} = 0.5 /\!/$

Damping freqnency of osullations $(wd) = Wn\sqrt{1 - J^2}$

  $wd = 6 \times \sqrt{1 - 5^2} = 6\sqrt{1 - (0.5)^2}$

  $wd = 5.192 \text{ rad/sec}$

we have obtained

  $Wn = (\text{rad/sec}) = J = 0.5 \text{ and } wd = 5.1696 \text{ rad/sec}$

② calculations of rise time (t_r)

  $t_r = \dfrac{\pi - 0}{wd} = \dfrac{\pi - \tan^{-1}\left(\dfrac{\sqrt{1 - J^2}}{J}\right)}{wd}$

$$= \frac{\pi - \tan^{-1}\left(\sqrt{1-0.5^2}\middle/0.5\right)}{5.8192}$$

$$= t_r = 0.4035$$

ii) Calculation of peak time (t_p)

$$t_p = \pi/w_d = \pi/5.196$$

$$t_p = 0.604s$$

iii) Peak overshoot (max overshoot) M_P

$$\% M_P = \frac{-J\pi}{e\sqrt{1-J^2}} \times 100$$

$$= \frac{-0.5 \times \pi}{e\sqrt{1-0.5^2}} \times 100 = 0.163 \times 100$$

$$= M_P = 16.3\%$$

iv) settling time (t_s)

for 2% tolerance

$$t_s = \frac{4}{Jw_n} = \frac{4}{0.5 \times 6} = 1.335$$

T_s for 2% is $= 1.33s$

for 5% is $\frac{4}{\underline{}}$

Step Response

Figure 1

```
timeanalysis.m    rlocus.m
1    num = [36]
2    den = [1 6 36]
3    sys = tf (num, den)
5    stepplot(sys)
6    stepinfo(sys)
```

Current Folder

Name ▲
- Published (my site)
- ECAAAT.slx
- rlocus.m
- rootlocus.pdf
- time analysis.m
- timeanalysis.m

Workspace

Name	Value	Size	Class
ans	1×1 struct	1×1	struct
den	[1,6,36]	1×3	double
num	36	1×1	double
sys	1×1 tf	1×1	tf

Command Window

```
    RiseTime: 0.2732
TransientTime: 1.3460
 SettlingTime: 1.3460
  SettlingMin: 0.9315
  SettlingMax: 1.1629
   Overshoot: 16.2929
  Undershoot: 0
        Peak: 1.1629
    PeakTime: 0.5987
>>
```

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matlab.mathworks.com

PO6. The engineer and Society: Apply Reasoning informed to assess societal, health, safety, legal and cultural issues and their consequent responsibility relevant to the professional engineering practice.

PO8. Ethics: — Apply Ethical principles and commit to professional ethics and responsibility and norms of Engineering Practice

PO9 Individual & team work function efficiently as an individual and as a member or leader.

PO10 Communication: — Communicate actively with the engineering Society and perform actively and be able to comprehend

Outcomes: —

1) We have effectively contributed towards the project and have learnt the necessary skill for the same.

2) Ethics: We have successfully practiced and understood the Ethics involves

3) We have individualy and equally contributed for the project

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY
"JnanaSangama" Belagavi- 590 018, Karnataka, India
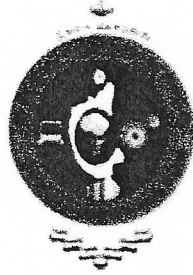
Submitted for the AAT
DEPARTMENT OF MEDICAL ELECTRONICS ENGINEERING
Physics Of Medical Imaging
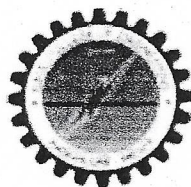### (19ML5PCPMI)

HOSPITAL VISIT REPORT

TEAMMATES	USN
Mandira V	1BM20MD028
Saphonia H Aaron	1BM20MD044
Varshini Manjunath	1BM20MD052

5+5 = 10
BNF
5+5 BNF
5+5 BNF

10/1/2023

Under the guidance of: Dr. Beena UllalaMata B N

BMS College of Engineering
(Autonomous Institution Affiliated to VTU)
Bull Temple Road, Bengaluru - 560019, Karnataka, India.
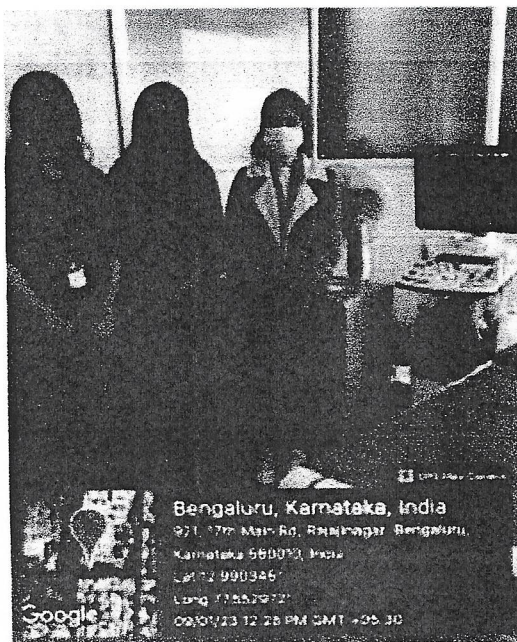
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CONTENTS

ACKNOWLEDGEMENT

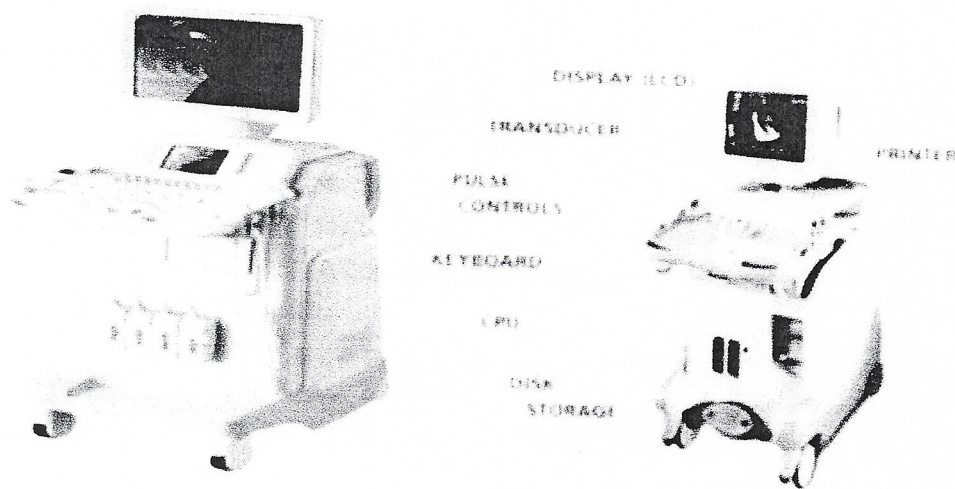# Hospital Visit To:
ESI HOSPITAL
(Rajajinagar, Bengaluru)

Good
16/1/2023

INTRODUCTION

We were given the opportunity to visit the Gynaecology Department of ESI Hospital as a part of our coursework. The Imaging Device that we got to see was **'Ultrasound'.**

ULTRASOUND:

- Medical Ultrasound refers to diagnostic imaging to diagnostic techniques(mainly imaging techniques) using ultrasound, as well as therapeutic applications of ultrasound.
- In diagnosis, it is used to create an image of internal body structures such as tendons, muscles, joints, blood vessels, and internal organs, to measure some characteristics (e.g. distances and velocities) or to generate an informative audible sound.
- The usage of ultrasound to produce visual images for medicine is called medical ultrasonography or simply sonography.
- The practice of examining pregnant women using ultrasound is called obstetric ultrasonography, and was an early development of clinical ultrasonography.
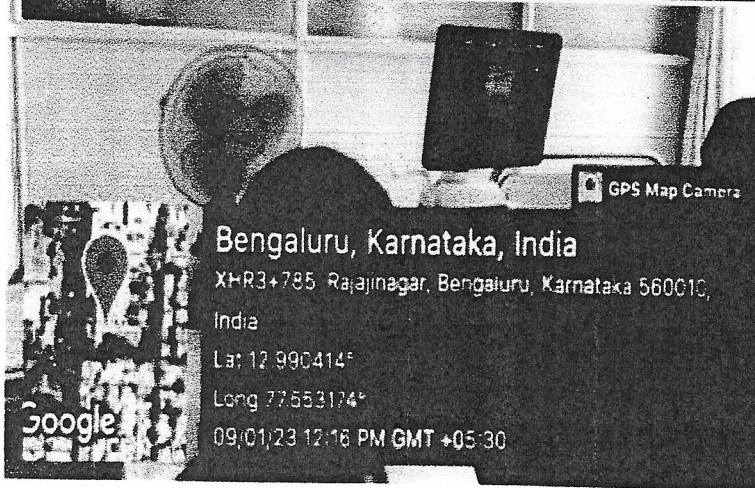
Working:

- Ultrasound imaging uses a small transducer (probe) to both transmit sound waves into the body and record the waves that echo back.

- Sound waves travel into the area being examined until they hit a boundary between tissues, such as between fluid and soft tissue, or soft tissue and bone. At these boundaries some of the sound waves are reflected back to the probe, while others travel further until they reach another boundary and are reflected back.

- Since the speed, direction, and distance sound waves travel differ depending on the boundary they run into, a computer can interpret this information as a two-dimensional image on a screen.

Procedure:

- Before the exam, you will change into a hospital gown. You will most likely be lying down on a table with a section of your body exposed for the test.

- An ultrasound technician, called a sonographer, will apply a special lubricating jelly to your skin. This prevents friction so they can rub the ultrasound transducer on your skin. The transducer has a similar appearance to a microphone. The jelly also helps transmit the sound waves.

- The transducer sends high-frequency sound waves through your body. The waves echo as they hit a dense object, such as an organ or bone.
- Those echoes are then reflected back into a computer. The sound waves are at too high of a pitch for the human ear to hear. They form a picture that can be interpreted by the doctor. Depending on the area being examined, you may need to change positions so the technician can have better access.

- After the procedure, the gel will be cleaned off of your skin. The whole procedure typically lasts less than 30 minutes, depending on the area being examined. You will be free to go about your normal activities after the procedure has finished.

CASE STUDY 1: Sonogram Of Rectus Femoris performed on a patient
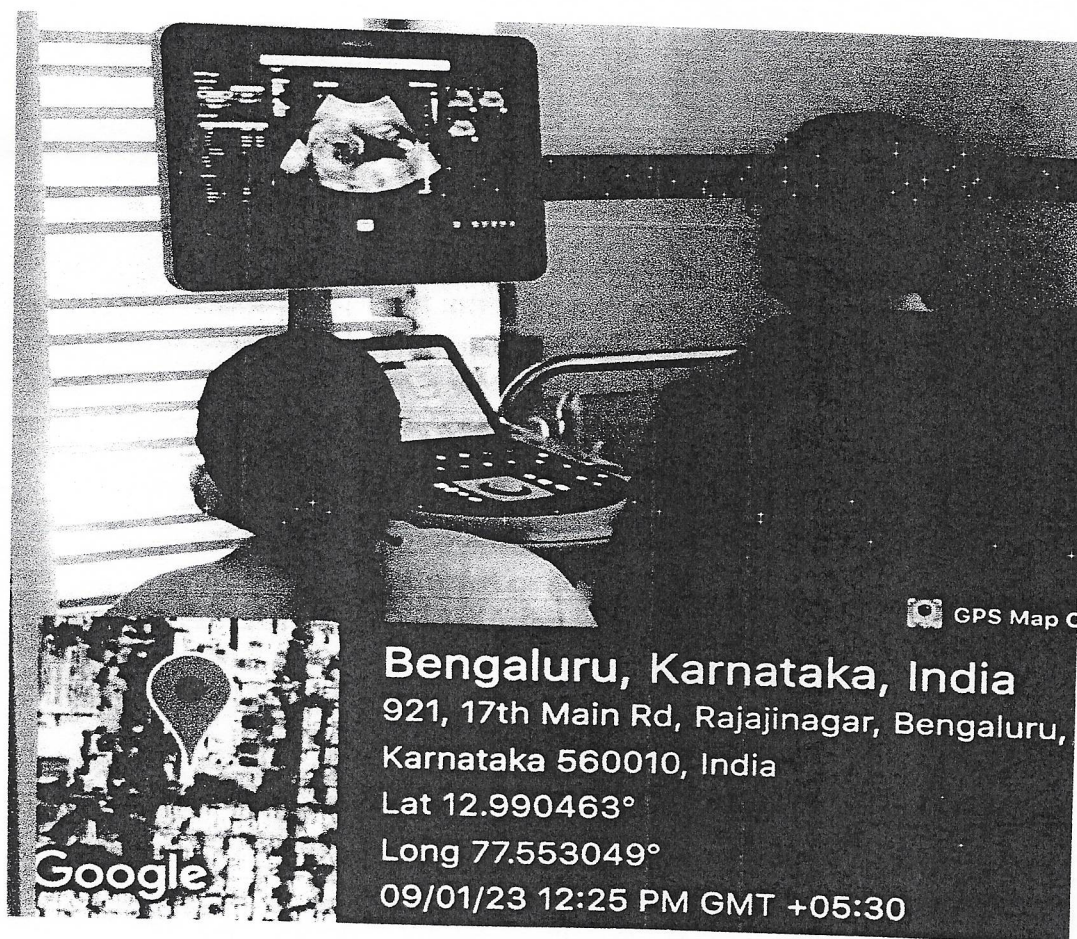
- The Rectus Femoris is a long, fleshy muscle located in the anterior compartment of the thigh.
- If there is a muscle tear due to an injury, sonography of Rectus Femoris is carried out to diagnose and treat the issue.

Bengaluru, Karnataka, India
XHR3+785 Rajajinagar, Bengaluru, Karnataka 560010, India
Lat 12.990414°
Long 77.553174°
09/01/23 12:16 PM GMT +05:30

CASE STUDY 2: Obstetric Ultrasonography

- Ultrasound performed on pregnant women is known as Obstetric Ultrasonography.
- One of the ethics followed during this is when a male radiologist/doctor is performing the ultrasound, a female assistant/attendant must be present.

Bengaluru, Karnataka, India
921, 17th Main Rd, Rajajinagar, Bengaluru,
Karnataka 560010, India
Lat 12.990463°
Long 77.553049°
09/01/23 12:25 PM GMT +05:30

SAFETY AND ETHICS

ETHICS

In terms of this framework, four ethical issues common to all ultrasound examinations are examined:

(1) competence to perform obstetric ultrasound and referral to specialists
(2) routine ultrasound screening
(3) disclosure of results
(4) confidentiality.

ethics
sta

SAFETY:

(1)The operator must not immerse any part of his/her body in the water bath in the path of the direct transmitted beam, while an ultrasound therapy device is operating in that water bath.

(2)Ultrasound therapy devices should only be turned on when the face of the applicator is in acceptable acoustic contact with the patient, and the operator is holding the applicator by its handle. Adherence to this guideline also reduces the possibility of thermal damage to the applicator.

(3)To help avoid any reflected or scattered ultrasound from entering the operator's hand during underwater treatments, a dry soft knit glove may be worn inside a rubber glove to provide air-gap protection.

(4)The applicator face must not be touched by the operator when the device is emitting ultrasound.

LITERATURE REVIEW

SL.NO	TITLE	AUTHOR, YEAR OF PUBLICATION	INFERENCE
1.	ULTRASOUND AND IT'S APPLICATION ON MEDICINE (ULTRASONOGRAPHY) A Term Paper	Aabiskar Subed July 2019	Ultrasound is good at imaging soft tissues even with pregnancy tests it is one of the reliable techniques. The Doppler effect can be used to detect blood flow. The accuracy of the test is very much operator dependent. This means that the key to a good test is the ultrasound technician.
2.	Superficial Endometriosis: The Ultrasound Diagnosis	G.M Zeni, J.Tigdi November 2022	Study Objective Review the background, clinical presentation, and options for diagnosing superficial endometriosis: 1) Illustrate the steps to visualize SE with ultrasound and the relevant sonographic features and 2) and discuss the clinical importance of a non-operative diagnosis as well as the limitations of ultrasound in this context

3.	ANALYSIS OF ULTRASOUND SIGNAL ON REFLECTION FROM A SHARP CORNER SURFACE	Vladimir MADOLA, Vladimir CVIKLOVIČ, Stanislav PAULOVIČ October 2022	The evaluation of correlation between the distance between object and the amplitude of ultrasonic signal is indicating a strong nonlinear dependence. The statistically significant difference between the planar reflection case of the ultrasound pulse versus the corner case suggest a possible correlation between the reflection case and the signal amplitude
4.	Artificial Life for Breast Ultrasound Image Segmentation	Nalan Karunanayake, Stanislav Makhanov October 2022	Breast ultrasound is a common imaging technique used to diagnose breast cancer. Ultrasound images are usually analysed by manual segmentation, which is a time-consuming process that can be inaccurate due to human error.
5.	Augmenting Endometriosis Analysis from Ultrasound Data using Deep Learning	Adrian Balica, Jennifer Dai July 2022	Endometriosis is a non-malignant disorder that affects 176 million women globally. Diagnostic delays result in severe dysmenorrhoea, dyspareunia, chronic pelvic pain, and infertility. Therefore, there is a significant need to diagnose patients at an early stage.

CONCLUSION

Ultrasound is widely available, easy to use and less expensive than most other imaging methods. We can get images of the body by recording echoes of ultrasound. Ultrasound is good at imaging soft tissues, even pregnancy tests it is one of the reliable techniques. The accuracy of the test is very much operator dependent. This means that the key to a good test is the ultrasound technician. Also, the hospital visit overall was a fun learning experience.

PROGRAMME OUTCOME:

PO	JUSTIFICATION
Engineering knowledge	Applied the knowledge of science and engineering fundamentals to understand the concept of Ultrasound
Problem analysis	Looked through research papers and analysed the problems that exist in Ultrasound and how it can be improvised.
The engineer and society	Assessed social, health, safety, and legal issues via our hospital visit.
Ethics	Followed all the protocols of the hospital and ensured that no patient was disturbed during our visit.
Individual and team work	All of us in the team have contributed equally and worked together to complete the assignment
Communication	We have communicated effectively with our guide, the hospital staff, our teammates and successfully completed the assignment.

REFERENCES

[1]   Ahlen, I., & Baagoe, H. J. (1999). Use of ultrasound detectors for bat studies in europe:experiences from field identification, surveys, and monitoring. Acta Chiropterologica,1(2), 137–150.

[2]   Aird, E. G. (1988). Basic physics for medical Imaging.

[3]   Bhatnagar, S. R., et al. (2012). Converting sound energy to electric energy.

[4]   Duck, F. A., Baker, A. C., & Starritt, H. C. (1998). Ultrasound in medicine.CRCPress.Gao,H.,Zhu,

[5]   K., Hu, G., & Xue, C. (2017). Large-scale graphene production by ultrasound-assisted exfoliation of natural graphite in supercritical co2/h2o medium.

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TO

The Administrative officer

Date: 09-01-23

Dear Sir/Madam,

Sub: Student's hospital visit

The department of medical electronics offering ~~Post~~ under graduation course-~~Biomedical signal processing and Instrumentation~~ Medical Elec Engg deals with electronics related to the medical field. Students' visit to hospitals will greatly contribute to their learning experience.

In this regard, we shall be grateful if you could kindly accommodate the following students of ours to visit suitable department of your esteemed hospital. We further request you to kindly sign on the form below for our records.

Semester : V

Course: Physics of medical imaging

<u>Students Details</u>:

Sl. No	Name	USN
1	Mandira V	1BM20MD028
2	Saphonia H Aaron	1BM20MD044
3	Varshini Manjunath	1BM20MD052

Yours Sincerely

(Dr BEENA ULLALA MATA B N)
Faculty /Course Coordinator
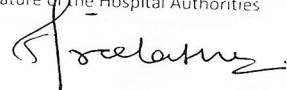

To be filled by the students

Name of the Hospital : ESI, Rajajinagar

Department visited : Gynaecology

Brief details of the experience obtained: We visited the gynecology department of ESI Hospital with the help of Dr. Sreelatha. We had to wait for a period of time for screening to begin. We got to see 2 cases of ultrasound. One being rectus femoris and the other was obstetric Ultrasonography. We learned about the working & how ultrasound is performed. Overall it was a fun learning experience.

Valued & noted

Dr. Sreelatha
Dept of Gynaecology
Signature of the Hospital Authorities
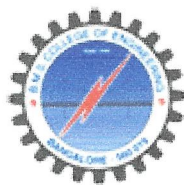
BMS COLLEGE OF ENGINEERING

(Autonomous college, affiliated to visveswaraya Techonological University)

DEPARTMENT OF MEDICAL ELECTRONICS

VII SEMESTER

SUBJECT : CLINICAL DATA ANALYTICS

COURSE CODE : 16ML7DCCDA

SELF STUDY

TOPIC : MULTIPLE REGRESSION

SI No	Student Name	USN	Marks Obtained	Signature of the Staff In charge R KALPANA
1	VIDYALAKSHMI K	1BM16ML025	10/10	
2	VINAY SHANKAR	1BM16ML027	09/10	

AIM:

TO OBTAIN MULTIPLE REGRESSION EQUATION USING EXCEL.

INTRODUCTION:

EXCEL:

The use of Excel is widespread in the industry. It is a very powerful data analysis tool and almost all big and small businesses use Excel in their day to day functioning.

MULTIPLE REGRESSION:

Multiple regression is an extension of simple linear regression.

It is used when we want to predict the value of a variable based on the value of two or more other variables.

The variable we want to predict is called the dependent variable (or sometimes, the outcome, target or criterion variable).

ADVANTAGES:

There are two main advantages to analyzing data using a multiple regression model. The first is the ability to determine the relative influence of one or more predictor variables to the criterion value. The real estate agent could find that the size of the homes and the number of bedrooms have a strong correlation to the price of a home, while the proximity to schools has no correlation at all, or even a negative correlation if it is primarily a retirement community.

The second advantage is the ability to identify outliers, or anomalies. For example, while reviewing the data related to management salaries, the human resources manager could find that the number of hours worked, the department size and its budget all had a strong correlation to salaries, while seniority did not. Alternatively, it could be that all of the listed predictor values were correlated to each of the salaries being examined, except for one manager who was being overpaid compared to the others.

Disadvantages :

Any disadvantage of using a multiple regression model usually comes down to the data being used. Two examples of this are using incomplete data and falsely concluding that a correlation is a causation.

When reviewing the price of homes, for example, suppose the real estate agent looked at only 10 homes, seven of which were purchased by young parents. In this case, the relationship between the proximity of schools may lead her to believe that this had an effect on the sale price for all homes being sold in the community. This illustrates the pitfalls of incomplete data. Had she used a larger sample, she could have found that, out of 100 homes sold, only ten percent of the home values were related to a school's proximity. If she had used the buyers' ages as a predictor value, she could have found that younger buyers were willing to pay more for homes in the community than older buyers.

ASSUMPTIONS:

Assumption #1: Your **dependent variable** should be measured on a continuous scale (i.e., it is either an **interval** or **ratio** variable). Examples of variables that meet this criterion include revision time (measured in hours), intelligence (measured using IQ score), exam performance (measured from 0 to 100), weight (measured in kg), and so forth.

Assumption #2: You have **two or more independent variables**, which can be either **continuous** (i.e., an **interval** or **ratio** variable) or categorical (i.e., an **ordinal** or **nominal** variable). For examples of **continuous** and **ordinal** **variables**

Assumption #3: You should have **independence of observations** (i.e., **independence of residuals**), which you can easily check using the Durbin-Watson statistic, which is a simple test to run using SPSS Statistics.

Assumption #4: There needs to be a **linear relationship** between (a) the dependent variable and **each** of your independent variables, and (b) the dependent variable and the independent variables **collectively**. Whilst there are a number of ways to check for these linear relationships, best method is creating **scatterplots** and **partial regression plots** using SPSS Statistics, and

then visually inspecting these scatterplots and partial regression plots to check for linearity.

Assumption #5: Finally, you need to check that the **residuals (errors)** are **approximately normally distributed** (we explain these terms in our enhanced multiple regression guide). Two common methods to check this assumption include using: (a) a histogram (with a superimposed normal curve) and a Normal P-P Plot; or (b) a Normal Q-Q Plot of the studentized residuals.

Simple vs. Multiple Regression

- One dependent variable Y predicted from one independent variable X

- One regression coefficient

- r^2: proportion of variation in dependent variable Y predictable from X

- One dependent variable Y predicted from a set of independent variables (X1, X2 ....Xk)

- One regression coefficient for each independent variable

- R^2: proportion of variation in dependent variable Y predictable by set of independent variables (X's)

EXAMPLE:

The measurements on CDA, age in years, and education level(years of schooling) for 5 subjects are shown in Table . We wish to obtain the sample multiple regression equation.(CDA refers to neural inhibitory mechanisms that focus the mind on what is meaningful while blocking out distractions)

Age	Ed-Level	CDA
72	20	4.57
68	12	−3.04
65	13	1.39
85	14	−3.55
84	13	−2.56

EQUATION:

- The multiple regression equation explained above takes the following form:

$$y = b_0 + b_1x_1 + b_2x_2 + \ldots + b_nx_n$$

OUTPUT OBTAINED USING EXCEL:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.81424078
R Square	0.662988048
Adjusted R Sq	0.325976095
Standard Error	7.555780881
Observations	5

ANOVA

	df	SS	MS	F	Significance F
Regression	2	224.6203506	112.310175	1.967254	0.337011952
Residual	2	114.1796494	57.0898247		
Total	4	338.8			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	28.85	29.27767395	0.98546424	0.428285	-97.119563	154.8237644	-97.119563	154.823764
X1	3.03	1.955688697	1.55115309	0.261027	-5.38107674	11.44822188	-5.3810767	11.4482219
X2	-3.55	1.790013752	-1.9828347	0.185859	-11.251109	4.152506108	-11.251109	4.15250611

Theoretical method to obtain multiple regression equation:

Y	X_1	X_2	X_1^2	X_2^2	X_1Y	X_2Y	X_1X_2
72	20	4.57	400	20.88	1440	329.04	91.40
68	12	-3.04	144	9.24	816	-206.72	-36.48
65	13	1.39	169	1.93	845	90.35	18.07
85	14	-3.55	196	12.60	1190	-301.75	-49.70
84	13	-2.56	169	6.55	1092	-215.04	-33.28
374	72	-3.19	1078	51.2	5383	-304.12	-9.99

$$\Sigma Y = 374 \qquad \text{(Total)} \Sigma X_1 Y = 5383 \qquad \Sigma x_1 y = -2.60$$

$$\Sigma X_1 = 72 \qquad \text{(Total)} \Sigma X_2 Y = -304.12 \qquad \Sigma x_2 y = -65.51$$

$$\Sigma X_2 = -3.19 \qquad \text{(Total)} \Sigma X_1 X_2 = -9.99 \qquad \Sigma x_1 x_2 = 35.95$$

$$\Sigma X_1^2 = 41.20$$

$$\Sigma X_2^2 = 49.16$$

$$\Sigma x_i^2 = \Sigma x_i^2 - \frac{(\Sigma x_i)^2}{N}$$

$$\Sigma x_1^2 = (1078) - \frac{(72)^2}{5} = 41.20$$

$$\Sigma x_2^2 = (51.2) - \frac{(-3.19)^2}{5} = 49.16$$

$$\Sigma x_i y = \Sigma x_i y - \frac{(\Sigma x_i)(\Sigma y)}{N}$$

$$\Sigma x_1 y = \Sigma x_1 y - \frac{(\Sigma x_1)(\Sigma y)}{N}$$

$$= 5383 - \frac{(72)(374)}{5} = -2.60$$

$$\Sigma x_2 y = -304.12 - \frac{(-3.19)(374)}{5} = -65.51$$

$$\Sigma X_1 X_2 = \Sigma x_1 x_2 - \frac{(\Sigma x_1)(\Sigma x_2)}{N} = -9.99 - \frac{(72)(-3.19)}{5}$$

$$\Sigma X_1 X_2 = 35.95$$

$$b_1 = \frac{(\Sigma x_2^2)(\Sigma x_1 y) - (\Sigma x_1 x_2)(\Sigma x_2 y)}{(\Sigma x_1^2)(\Sigma x_2^2) - (\Sigma x_1 x_2)^2}$$

$$b_1 = \frac{(49.16)(-2.60) - (35.95)(-65.51)}{(41.20)(49.16) - (35.95)^2}$$

$$\boxed{b_1 = 3.04}$$

$$b_2 = \frac{(\Sigma x_1^2)(\Sigma x_2 y) - (\Sigma x_1 x_2)(\Sigma x_1 y)}{(\Sigma x_1^2)(\Sigma x_2^2) - (\Sigma x_1 x_2)^2}$$

$$b_2 = \frac{(41.20)(-65.51) - (35.95)(-2.60)}{(41.20)(49.16) - (35.95)^2}$$

$$\boxed{b_2 = -3.55}$$

$$b_0 = \bar{y} - b_1 \bar{X_1} - b_2 \bar{X_2}$$

$$b_0 = \frac{374}{5} - (3.04)\frac{72}{5} - (-3.55)\frac{(-3.19)}{5}$$

$$\boxed{b_0 = 28.76}$$

Equation:

$$y = b_0 + b_1 X_1 + b_2 X_2$$

$$\boxed{\therefore y = 28.76 + 3.04 X_1 - 3.55 X_2}$$

RESULT:

The output obtained matches with the theoretical equation.