I

Name.....

Roll No. .....Year 20.....20.....

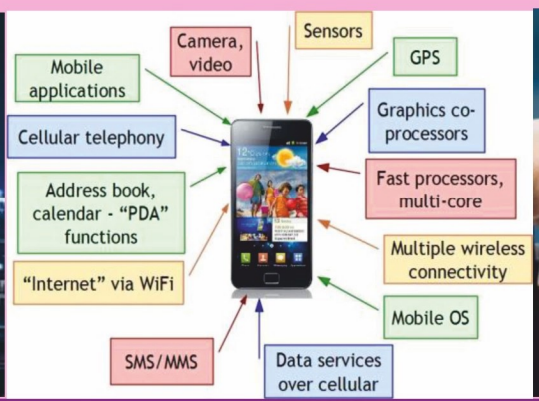
Exam Seat No.....

COMPUTER GROUP | SEMESTER – VI | DIPLOMA IN ENGINEERING AND TECHNOLOGY

A LABORATORY MANUAL

FOR

WIRELESS AND MOBILE NETWORK (22622)



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

(Autonomous) (ISO 9001 : 2015) (ISO / IEC 27001 : 2013)

A Laboratory Manual

for

Wireless and Mobile Network

(22622)

Semester -VI

Diploma in Information Technology

Maharashtra State
Board of Technical Education, Mumbai
(Autonomous) (ISO-9001-2008) (ISO/IEC 27001:2013)

Maharashtra State
Board of Technical Education, Mumbai

(Autonomous) (ISO-9001-2015) (ISO/IEC 27001:2013)

4th Floor, Government Polytechnic Building, 49, Kherwadi,
Bandra (East), Mumbai – 400051.

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Maharashtra State
Board of Technical Education
Certificate

This is to certify that Mr. / Ms ……. Roll No……. of Sixth Semester of Diploma in ……. of Institute ……..... (Code……) has completed the term work satisfactorily in subject **Wireless and Mobile Network** (22622) for the academic year 20…….to 20…..... as prescribed in the curriculum.

Place ……. Enrollment No……
Date:…..... Exam Seat No. …….....

Subject Teacher **Head of the Department** **Principal**

Seal of the Institute

Preface

The primary focus of any engineering laboratory/field work in the technical education system is to develop the much needed industry relevant competencies and skills. With this in view, MSBTE embarked on this innovative 'I' Scheme curricula for engineering Diploma programmes with outcome-based education as the focus and accordingly, relatively large amount of time is allotted for the practical work. This displays the great importance of laboratory work making each teacher, instructor and student to realize that every minute of the laboratory time need to be effectively utilized to develop these outcomes, rather than doing other mundane activities. Therefore, for the successful implementation of this outcome-based curriculum, every practical has been designed to serve as a ***'vehicle'*** to develop this industry identified competency in every student. The practical skills are difficult to develop through 'chalk and duster' activity in the classroom situation. Accordingly, the 'I' scheme laboratory manual development team designed the practical's to ***focus*** on ***outcomes***, rather than the traditional age old practice of conducting practical's to 'verify the theory' (which may become a byproduct along the way).

This laboratory manual is designed to help all stakeholders, especially the students, teachers and instructors to develop in the student the pre-determined outcomes. It is expected from each student that at least a day in advance, they have to thoroughly read the concerned practical procedure that they will do the next day and understand minimum theoretical background associated with the practical. Every practical in this manual begins by identifying the competency, industry relevant skills, course outcomes and practical outcomes which serve as a key focal point for doing the practical. Students will then become aware about the skills they will achieve through procedure shown there and necessary precautions to be taken, which will help them to apply in solving real-world problems in their professional life.

This manual also provides guidelines to teachers and instructors to effectively facilitate student-centered lab activities through each practical exercise by arranging and managing necessary resources in order that the students follow the procedures and precautions systematically ensuring the achievement of outcomes in the students.

Although all care has been taken to check for mistakes in this laboratory manual, yet it is impossible to claim perfection especially as this is the first edition. Any such errors and suggestions for improvement can be brought to our notice and are highly welcome.

Programme Outcomes (POs) to be achieved through Practicals of this Course

Following programme outcomes are expected to be achieved significantly out of the ten programme outcomes and Information Technology programme specific outcomes through the practicals of the course on **Wireless and Mobile Network.**

PO1. Basic knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the problems related to application of computers and communication services in storing, manipulating and transmitting data, often in the context of business or other enterprise.

PO2. Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO3. Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO4. Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

PO5. The engineer and society: Assess societal, health, safety and legal issues and the consequent responsibilities relevant to practice in the field of Information Technology.

PO6. Environment and sustainability: Apply information Technology related engineering solutions for sustainable development practices in environmental contexts.

PO7. Ethics: Apply ethical principles for commitment to professional ethics, responsibilities and norms of practice in the field of Information Technology.

PO8. Individual and teamwork: Function effectively as a leader and team member in diverse/ multidisciplinary teams.

PO9. Communication: Communicate effectively in oral and written form.

PO10. Life-long learning: Engage in independent and life-long learning along with the technological changes also in the IT and allied industry.

Program Specific Outcomes (PSOs):-

PSO1:Modern Information Technology: Use latest technologies for operation and application of information.

PSO2:Information Technology Process: Maintain the information processes using modern information and communication technologies.

Practical- Course Outcome matrix

S. No.	Title of the Practical	CO a.	CO b.	CO c.	CO d.	CO e.
1.	Test the different sections of mobile phone.(such as ringer section, dialer section, receiver section and transmitter section)	√	-	-	-	-
2.	Perform the process of call connection and call release of cellular Mobile system.	√	-	-	-	-
3.	Transfer an image, audio and video file using Bluetooth protocol with varying distance between two devices and analyze the performance.	-	√	-	-	-
4.	Configure Wi-Fi setting in mobile devices using mobile tethering to connect two devices such as mobile phone to mobile phone, mobile phone to laptop.	-	√	-	-	-
5.	Apply RFID technology for real life applications using RFID kit.	-	√	-	-	-
6.	Establish seamless wireless connectivity using multiple access point.	-	√	-	-	-
7.	Use AT commands to understand working of 3G network using 3G mobile phone Trainer kit.	-	-	√	-	-
8.	Check network availability manual and auto selection of network using AT commands in mobile.	-	-	√	-	-
9.	Simulate Bluetooth voice transmission to observe effect of AWGN and of interference of 802.11b on transmission using MATLAB and simulink.	-	√	-	-	-
10.	Develop a mobile application for wireless technology using any wizards such as available on www.appypie.com or any other.	-	-	√	-	-
11.	Simulate the line coding techniques using MATLAB and simulink	-	-	-	√	-
12.	Simulate the Binary amplitude shift keying using MATLAB and simulink.	-	-	-	√	-
13.	Simulate the Binary phase shift keying using MATLAB and simulink	-	-	-	√	-
14.	Simulate the Delta Modulation using MATLAB and simulink.	-	-	-	√	-
15.	Simulate the Direct sequence spread spectrum using MATLAB and simulink.	-	-	-	√	-
16.	Simulate WSN node to determine position on node and blink LED using cupcarbon simulator and senscript.	-	-	-	-	√

List of Industry Relevant Skills

The following industry relevant skills of the competency 'Maintain Wireless and Mobile Networks' are expected to be developed in students by undertaking the practical's of this laboratory manual.

1. Identify the components of mobile phone.
2. Identify the component of GSM Network.
3. Test electronic component.
4. Test the various Input/output devices of mobile phone.
5. Select the electronic component of proper value as per the requirement.
6. Identify the fault at different section and suggest suitable remedy.
7. Execute various AT commands for a GSM modem.
8. Build a personal area Network.
9. Follow the procedural steps for hard reset function of a mobile phone.
10. Interpret waveforms of different digital communication.
11. Select the proper communication system as per the requirement.
12. Compare the observed output with the expected output.
13. Use relevant EDA tool for simulating Wireless and Mobile Network.

Brief Guidelines to Teachers

Hints regarding strategies to be used

1. Teacher shall explain prior concepts to the students before starting each experiment.
2. For practical's requiring tools to be used, teacher should provide the demonstration of the practical emphasizing the skills, which the student should achieve.
3. Involve students in the activities during the conduct of each experiment.
4. Teachers should give opportunity to students for hands-on after the demonstration.
5. Assess the skill achievement of the students and COs of each unit.
6. Teacher is expected to share the skills and competencies to be developed in the students.
7. Teacher should ensure that the respective skills and competencies are developed in the students after the completion of the practical exercise.
8. Teacher may provide additional knowledge and skills to the students even though that may not be covered in the manual but are expected from the students by the industries.
9. Teacher may suggest the students to refer additional related literature of the reference books/websites/seminar proceedings etc.
10. During assessment teacher is expected to ask questions to the students to tap their knowledge and skill related to that practical.

Instructions for Students

Student shall read the points given below for understanding the theoretical concepts and practical applications.

1. Students shall listen carefully the lecture given by teacher about importance of subject, learning structure, course outcomes.
2. Students shall organize the work in the group of two or three members and make a record of all observations.
3. Students shall understand the purpose of experiment and its practical implementation.
4. Students shall write the answers of the questions during practical.
5. Student should feel free to discuss any difficulty faced during the conduct of practical.
6. Students shall develop maintenance skills as expected by the industries.
7. Student shall attempt to develop related hands on skills and gain confidence.
8. Students shall refer technical magazines; websites related to the scope of the subjects and update their knowledge and skills.
9. Students shall develop self-learning techniques.
10. Students should develop habit to submit the write-ups on the scheduled dates and time.

Content Page

List of Practicals and Progressive Assessment Sheet

- To be transferred from Proforma of CIAAN-2017

Practical No. 1: Test the different sections of mobile phone

I. Practical Significance:

Today we can connect to the network from anywhere, with anybody, at anytime. Mobile phones play a very important role in making this connectivity possible. A knowledge of the various components of the mobile handset helps in troubleshooting and maintenance of the handsets. A mobile phone consists of various sections that include transmitter/receiver section, buzzer and vibrator section, power supply section, display section, SIM card section. This practical will help the students to test different sections of the mobile phone unit.

II. Relevant Program Outcomes (POs)

PO2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO4- Engineering Tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

PO6- Environment and sustainability: Apply Information Technology related engineering solutions for sustainable development practices in environmental contexts.

PO10- Life-long learning: Engage in independent and lifelong learning along with the technological changes also in the IT and allied industry.

III. Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency **'Maintain Wireless and Mobile Networks'**.

1. Identify the various sections of mobile handsets.
2. Install the SIM card in the mobile phone.
3. Measure voltages & draw waveforms at the output of different sections of mobile phone.

IV. Relevant Course Outcome(s)

Select cellular Mobile system standard.

V. Practical Outcome(PrOs)

Identify different sections and components of mobile phone such as ringer section, dialer section, receiver section and transmitter section, camera, microphone, speaker and flash light.

VI. Relevant Affective Domain related Outcome(s)

1. Handle equipment carefully.
2. Demonstrate working as a leader / a team member.
3. Follow ethical practices
4. Follow safety practices.

VII. Minimum Theoretical Background

A mobile phone also known as a cellular phone, cell phone, hand phone, or simply a phone is a phone that can make and receive telephone calls over a radio link while moving around a wide geographic area. It does so by connecting to a cellular network provided by a mobile phone operator, allowing access to the public telephone network.

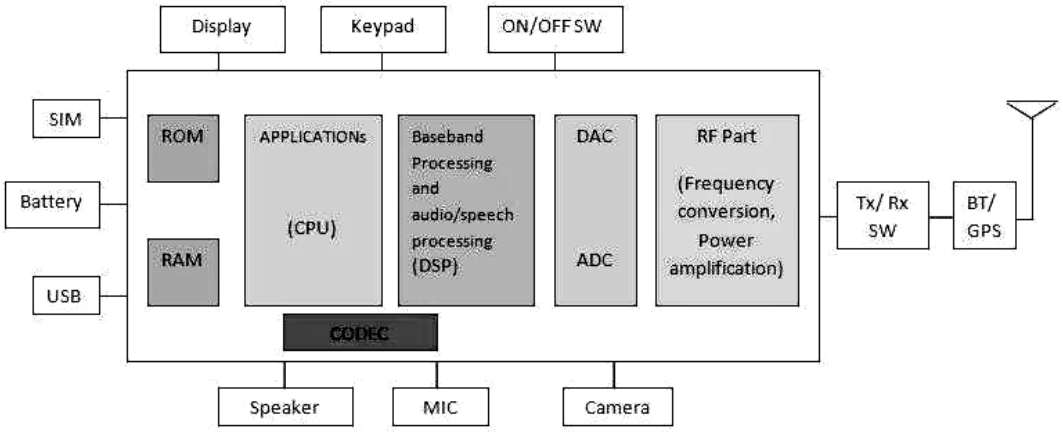

Figure 1: Block diagram of Mobile Unit

RF section:

RF signal is filtered and down converted to analog baseband signals in the RF section. RF section consists of 2 main circuits i.e. Transmitter and Receiver.

Analog Baseband / Voice band Codec:

Analog baseband signals from RF receiver section are filtered, sampled, and digitized before being fed to the DSP section. The coded speech digital information from DSP section are sampled and converted to analog baseband signals which is then fed to the RF transmitter section. The voice speech from the microphone is digitized and coded to a certain bit rate (13kbps for GSM) using the appropriate coding scheme. The received voice call binary information are decoded and converted in the speaker.

DSP / Microprocessor:

The digital signal processor (DSP) is designed to perform signal manipulation calculations at high speed. The microprocessor handles all signaling for the keyboard and display; deals with command and control signaling with the base station and also coordinates the rest of the functions on the board.

Flash Memory, ROM, SRAM (SIM card):

The ROM, SRAM, and Flash memory chips provide storage for the phone's operating system and customizable features, such as the phone directory. The SIM card stores the subscriber's identification number and other network information.

Power Management / DC- DC:

This section regulates from the battery all the voltages required to the different Phone sections.

Transmitter and Receiver section: Signal to the transmitter is the audio signal from the microphone of the mobile handset. This analog / audio signal is converted into digital signal by the ADC. It is further modulated by the GMSK scheme and the modulated signal is transmitted through a transmitting antenna. The signal to the receiver is the modulated signal which is demodulated into digital signal. This digital signal is converted into analog form with the help of DAC. The analog signal is then given to the speaker.

VIII. Work Situation

1. Faculty will demonstrate to identify and test different sections of mobile unit and functions.

Stepwise Procedure:

1. Connect power to the trainer kit, insert SIM card in the position provided and switch the power supply ON.

a. Testing of Tx/Rx Section:

1. Make a call from trainer to the trainer from other mobile or landline phone and keep it ON.
2. Check the signal on spectrum analyser and record the same.
3. Make a call from trainer to other mobile or landline phone and keep it ON.
4. Check the signals on spectrum analyzer and record the same.

b. Testing of Battery and Battery charger section:

1. Measure the Battery voltages at different test points on multimeter and record it.
2. Measure the Battery charger voltage on multimeter and record it.

c. Testing of Power Management Unit:

1. Measure the voltages at different test points of power management unit of mobile phone on multimeter and record it.

d. Testing of LCD Display Section:

1. Measure the voltages at different test points of LCD display section of mobile phone unit.

e. Testing of SIM card Section:

1. Measure the voltage at the different pins of SIM card on multimeter and record it.
2. Check the clock signal on CRO/Spectrum analyzer.

f. Testing of User Interface Section/Ringer,Dialer Section:

1. Make a call to trainer kit.
2. Observe the condition like LED ON melody ringtone ringing and vibrator motor running.
3. Check the various signals of this section on CRO/Spectrum analyzer and record the same.

IX. Resources required (Additional)

S. No.	Instrument /Components	Specification	Quantity	Remarks
1.	GSM Trainer Kit	2G/3G/4G GSM Trainer Kit	1 No.	
2.	SIM card	Any type micro, Nano or Standard SIM	1 No.	
3.	CRO/DSO	20MHz,dual trace, dual beam	1 No.	
4.	Spectrum analyzer	1GHz	1 No.	
5.	DMM	3 1/2 Digit	1 No.	
6.	Connecting Wires	Banana plugs	4 No.	

X. Observations

Tx/Rx Section

Test Points	Observed Voltage
Tx signal at Antenna	
Rx signal at Antenna	
Tx IQ signals	
Rx IQ signals	

Battery and Battery Charger Section

Test Points	Standard Voltage(V)	Observed Voltage
Battery Voltage TP 12	3.7V approx.	
Battery Status Indicator when battery is discharge TP 13	0V	
Battery Status Indicator when battery is charging TP 13	0.5V approx.	
Battery Ground	0V	
Battery Charger Supply	6V approx.	
Charger Voltage	6V approx.	

Power Management Unit

Test Points	Standard Voltage(V)	Observed Voltage
Battery Voltage	3.7V approx.	
VCC TP 51	3.7V approx.	
V RF TP 52	2.8V approx.	
VDD IO TP 53	1.8V approx.	
VDD INT TP 54	2.8V approx.	
V CPU TP 55	1.8V approx.	
VCTCXO TP 56	2.8V approx.	

LCD Section

Test Points	Standard Voltage(V)	Observed Voltage
LCD operating Voltage TP 6	3.8V approx.	
LED operating Voltage TP 7	1.8V approx.	
Write Enable Signal TP 8		
Display control signal TP 9		
I/O Voltage TP 10	2.8V approx.	
Reset Voltage TP 11	1.6V approx.	
LCD Reset	6V approx.	
LCD Voltage Tripler TP 33	-10V approx.	
LCD Voltage Tripler TP 37	10V approx.	
LCD Voltage TP 34	6V approx.	
LCD Voltage TP 35	-10V approx.	
LCD Clock TP 36	0V approx	

SIM Section

Test Points	Standard Voltage(V)	Observed Voltage
SIM VCC	2.8V approx.	
SIM Reset	2V approx.	
SIM Clock	Observe Frequency 3.2MHz	
SIM Data	2.8V approx.	
SIM Supply Voltage	2V approx.	
SIM GND	GND	
Input Charging Voltage	6.9V approx.	
Output Charging Voltage	3.6V approx.	

User Interface Section/Ringer, Dialer Section

Test Points	Standard Voltage(V)	Observed Voltage
Buzzer PWM Control Signal	5V approx.	
Vibrator PWM Control Signal	5V approx.	
LED ON and OFF	2V approx.	

XI. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. State the frequency spectrum allocated for GSM and the bandwidth of each channel.
2. State the number of pins of SIM in a mobile phone.
3. State the information in SIM.
4. Write advantages and disadvantages and security services offered by GSM.
5. Write the two basic reasons for a handover in GSM.

XII. Exercise

Note: Faculty must ensure that every group of students use different input value.

(Use blank space for answers or attach more pages if needed)

Problem Statement:

Using the following data for a GSM 1800 network, calculate, Average busy hour traffic per subscriber, Traffic capacity/ cell, Required no. of BS/ zone, the hexagonal cell radius for zone

Given Data

Subscriber usage/month=150 min/Days/month= 24,Busy hrs/day = 6,
Allocated spectrum = 4.8MHz,Frequency reuse plan= 4/12,RF
channel width= 200 KHz (FR),
Present no. of subscribers in the zone= 50000,
Subscriber growth = 5%/ year, Capacity of BS TxRx (BTS) = 30 Erlangs,
Area of zone = 500 Km^2,Network rollover period = 4 yrs

Plot and Observe the graphs using MATLAB and Simulink.

1. Total no. of subs. in initial installation verses Subs growth in %
2. Total no. of BTS/zone verses Subs growth in %
3. Hexagonal cell radius for zone verses Subs growth in %

(Space for answers)

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XIII. References / Suggestions for further Reading

1. https://www.youtube.com/watch?v=3ju9uXV-RJY
2. https://www.youtube.com/watch?v=fYRFelGABk8
3. www.mobilecellphone repairing.com

XIV. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1.	Proper handling of the equipment	20%
2.	Identifying the various blocks and Test points	20%
3.	Inserting the SIM card properly and measurement of voltage	20%
Product related (10 Marks)		**40%**
4.	Practical related questions and Results	20%
5.	Completion and submission of practical in time	10%
6.	Expected Output/Observation	10%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 2: Perform the process of call connection and call release of cellular Mobile System

I. Practical Significance

The command set consists of a series of short text strings which can be combined to produce commands for operations such as dialing, managing SMS functions and changing the parameters of the connection. Many of the commands that are used to control wired dial-up modems, such as ATD (Dial),ATA (Answer),ATH(Hook control) and ATO (Return to online data state),are also supported by GSM/GPRS modems and mobile phones. This practical will help the students to execute call control functionality of a GSM module.

II. Relevant Program Outcomes (POs)

PO2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

PO8- Individual and team work: Function effectively as a leader and team member in diverse/multidisciplinary teams.

III. Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency **'Maintain Wireless and Mobile Network'**.

1. Identify the components on GSM modem and identify the commands for executing call control commands.
2. Use GSM modem and identify various call control AT commands.

IV. Relevant Course Outcome(s)

Select cellular Mobile system standard.

V. Practical Outcome(PrOs)

Perform the process of call connection and call release of cellular Mobile system.

VI. Relevant Affective Domain Related Outcome(s)

1. Maintain tools and equipment.
2. Demonstrate working as a leader / a team member.
3. Follow ethical practices.

VII. Minimum Theoretical Background

Mobile call origination in GSM:

1. The MS sends the dialed number indicating service requested to the MSC(via BSS)
2. The MSC checks from the VLR if the MS is allowed the requested service.If so, MSC asks BSS to allocate necessary resources for the call.

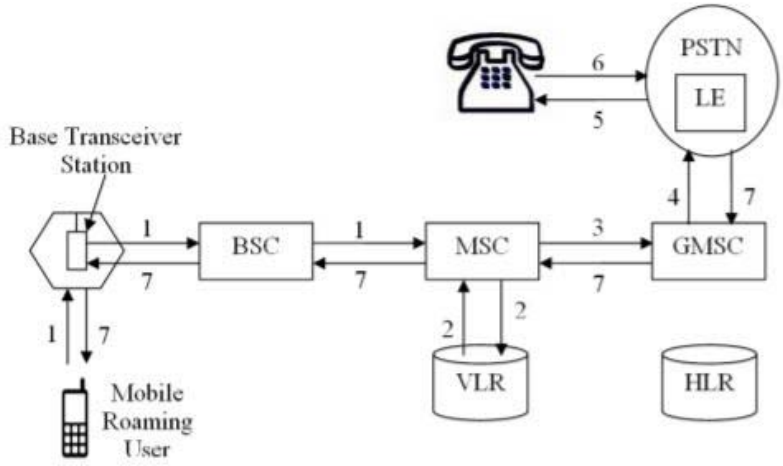

Figure 1: Mobile call origination

3. If the call is allowed,the MSC routes the call to GMSC.
4. The GMSC routes the call to the local exchange of called user.
5. The LE alerts (applies ringing) the called terminal.
6. Answer back (ring back tone) from the called terminal to LE.
7. Answer back signal is routed back to the MS through the serving MSC which also completes the speech path to the MS.

Mobile call termination:

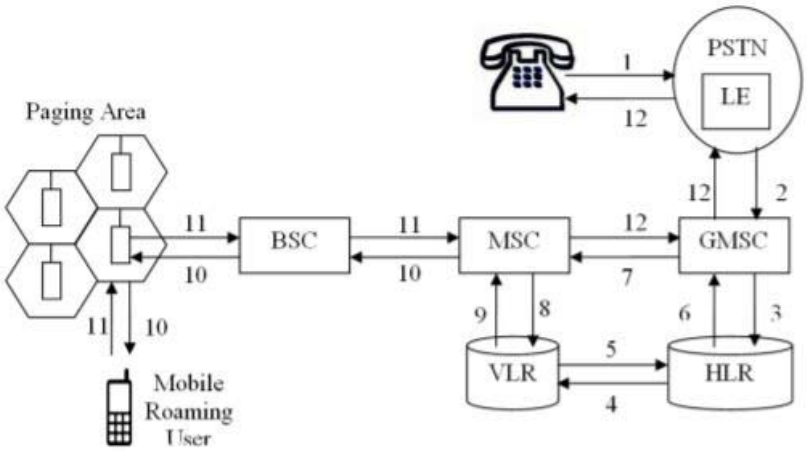

Figure 2: Mobile call termination

1. The PSTN user dials the MSISDN of the called user in GSM.
2. The LE routes the call to the GMSC of the called GSM user.
3. The GMSC uses the dialed MSISDN to determine the serving HLR for the GSM user and interrogates it to obtain the required routing number.
4. The HLR requests the current serving VLR for the called MS for a MSRN (MS roaming number) so that the call can be routed to the correct MSC.
5. The VLR passes the MSRN to the HLR.
6. The HLR passes the MSRN to the GMSC.
7. Using the MSRN, the GMSC routes the call to the serving MSC.
8. The MSC interrogates the VLR for the current location area identity (LAI) for the MS.
9. The VLR provides the current location for the MS.

10. The MSC pages MS via the appropriate BSS. The MS responds to the page and sets up the necessary signaling links.
11. When the BSS has established the necessary radio links. the MSC is informed and the call is delivered to the MS.
12. When the MS answers the call, the connection is completed to the calling PSTN user.

VIII. Work Situation

1. Faculty will demonstrate the use of Call Control Commands and execute.
2. Faculty must form a group of two students.
3. Students group will practice Call Control Commands and execute them.

Call Control Commands:

1. **ATD:** This command is used to establish a voice call.
   Concept Structure:

Command	Possible Response
ATD <number>	CONNECT<speed> If call is Established
	BUSY if Called party is on another call.
	NO ANSWER if called party does not receive a call
	NO CARRIER If there is a problem in establishing a call.

2. **ATA:** Command is used to accept an incoming call.
   Concept Structure:

Command	Possible Response
ATA	OK If incoming call is a voice call.

3. **ATD<n>:** This command dials the phone number with accordance to the modifiers of n.
   Defined values: **<n>**

L	Redial the last dialed number
P	Pulse dial
R	Enable answer mode
S=x	Dial the stored telephone number in x
T	Tone dials
W	Resume dialing after dial tone is detected
,	Pause before dial
“555-4NET”	Letters enclosed on quotes will be dialed as their corresponding numbers on the dialpad.
!	Enable “flash”.(Modem can go off hook for a specified amount of time before returning on hook.
@	Modem will wait for a quiet answer before dialing the rest of the dial string.

4. **ATH:** This command is used to end the call.

5. **AT+CCFC:** Command is used to set the call forwarding service.
   Concept Structure:

Command	Possible Response	
AT+CCFC =<reason>,<mode> [,<number>]	OK When <mode>=2: +CCFC: <status>,<class>	+CME ERROR:<err>
AT+CCFC=?	+CCFC(list of supported <reason>s)	+CME ERROR:<err>

Defined values:

<reason>

0	Unconditional
1	Mobile busy
2	No reply
3	Not reachable
4	All call forwarding
5	All conditional call forwarding

<mode>

0	Disable
1	Enable
2	Query status
3	Registration
4	Erasure

<number> : Telephone number to forward to.

<class> **:** Is a sum of integers each representing a class of information (default 7 equals to all classes):

1	Voice
2	Data
4	Fax

<status**>**

0	Not active
1	Active

Remarks: none

Source: GSM07.07/7.10

Implementation: Complete

6. **AT+CLIP:** Command is used to set and request the status of the calling line identification presentation service.Depending on the setting the number of the calling party will be shown as result code+CLIP:<number>,<type> on incoming calls (after every RING).

Concept Structure:

Command	Possible Response
AT+CLIP=[<n>]	OK
AT+CLIP?	+CLIP=<n>,<m>
AT+CLIP=?	+CLIP:(list of supported <n>s)

Defined values: **<n>** (Parameters sets/shows the result code presentation status):

0	Disable
1	Enable

<m> (Parameters shows the subscriber CLIP service status in the network):

0	CLIP not provisioned
1	CLIP provisioned
2	Unknown (eg.no network,etc)

<number> String type phone number of format specified by <type>.
<type> Type of address octet in integer format.
Remarks: none
Source: GSM07.07/7.6
Implementation: Complete

IX. Resources required (Additional)

S. No.	Instrument /Components	Specification	Quantity	Remarks
1	Computer System	A basic computer system with Minimum Configuration and operating system like Windows 2000/xp/vista/2007/2010	01	
2	GSM Modem	SIM 300 or higher	01	
3	SIM Card	Any 3G network SIM card	01	
4	Serial Cable	DB-9 serial connector	01	
5	Adapter	12V DC	01	

X. Precautions to be followed

1. Insert SIM Card Properly.
2. Make sure the SIM is having network coverage.
3. Type the AT Commands after reading their use, as it might reset/Format the SIM Data.

XI. Procedure

Steps for connecting GSM Modem with Hyper terminal software:

1. Connect the setup as shown in the block diagram given below.

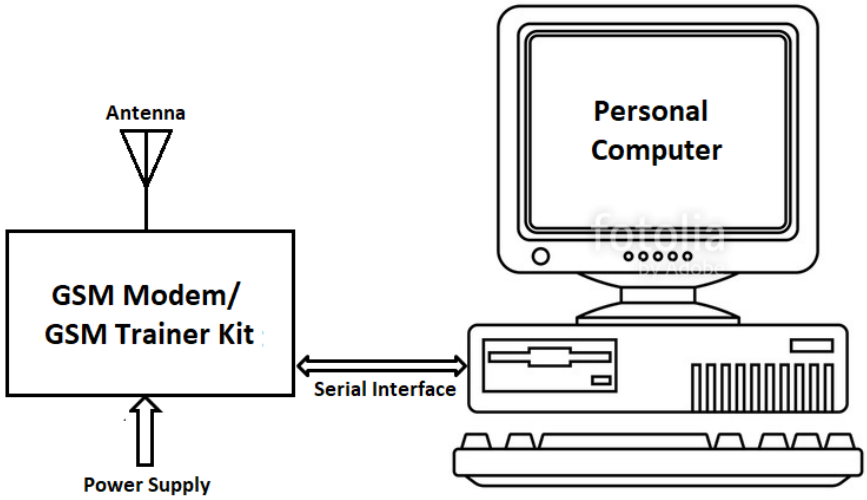

Figure 3: Interfacing diagram of GSM Modem and Computer

2. Start the PC and load the required software for GSM modem/Trainer.
3. Start the Hyper terminal software.
4. Open File->New Connection

Figure 4: Screenshot of hyper terminal software

5. Set the COM1 properties with default values as:
   Speed/Baud rate:9600
   Data Bits:8
   Parity: None
   Stop Bit:1
   Flow Control: None
6. Type **"AT"** on the screen (command line) and detect connection by receiving response **"OK"**
7. Type the various commands and check their responses.
8. Record the responses of given various commands in the observation table.

XII. Student Activity (Additional)

(Teacher shall form group of 4 to 5 students and effect of allot any one activity from the following)

1. Draw the screen shot of mobile handset for various commands
2. Draw the call procedure for making call from mobile unit.
3. Draw the call procedure for making call from landline to mobile phone.

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XIII. Observations

(Use blank sheet provided if space not sufficient)

Observe Command response and write their Responses.

Sr. No.	Command	Response

XIV. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. What do you mean by PSTN?
2. What is the effect of field strength on call connection?
3. List Network Service types.
4. State the websites providing free SMS service.
5. What is the additional band proposed for 4G mobile system? How a user is alerted for the incoming call using paging mechanism of mobile network.

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XV. References / Suggestions for further Reading

1. www.mobilecomms-technology.com
2. www.gsmworld.com
3. www.communica.se/multitec/gprs_at.pdf
4. www.sparkfun.com/datasheets/cellularModules/AT_Commands_Reference_Guide_r0.pdf
5. www.zeeman.de/wp-content/uploads/2007/09/ubinetics-at-command-set.pdf

XVI. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Use of GSM Modem with Hyper terminal Software	20%
2	Identifying AT Commands for an experiment	30%
3	Follow ethical practices	10%
Product related (10 Marks)		**40%**
4	Observations and recording	20%
5	Answer to sample questions	15%
6	Timely Submission of report	05%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……..

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 3: Transfer an image, audio and video file using Bluetooth protocol with varying distance between two devices and analyze the performance.

I. Practical Significance

Bluetooth is a wireless technology standard for exchanging data over short distances using short-wavelength UHF radio waves in the ISM band from 2.400 to 2.485 GHz from fixed and mobile devices, and building personal area networks (PANs).It was originally conceived as a wireless alternative to RS-232 data cables. One thing keeps skipping people's attention is Bluetooth. Before portable hotspot and Wi-Fi tethering was a thing, which is shared in phone internet using Personal Area Networks, also called Bluetooth Tethering. This experiment will help the students to setup Personal Area Network, Bluetooth.

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II. Relevant Program Outcomes (POs)

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

PO 8- Individual and team work: Function effectively as a leader and team member in diverse/multidisciplinary teams.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency **'Maintain Wireless and Mobile Networks'.**

1. Use Bluetooth device to create a small network and identify the various settings require for creating a network.

IV. Relevant Course Outcome(s)

Maintain wireless network Technologies.

V. Practical Outcome(PrOs)

Transfer an image, audio and video file using Bluetooth protocol with varying distance between two devices and analyze the performance.

VI. Relevant Affective Domain Related Outcome(s)

1. Maintain tools and equipment.
2. Demonstrate working as a leader / a team member.
3. Follow ethical practices.

VII. Minimum Theoretical Background

Bluetooth technology is a wireless communications technology that is simple, secure and everywhere. Anyone can find it in billions of devices ranging from mobile phones and computers to medical devices and home entertainment products. It is intended to replace the cables connecting devices, while maintaining high levels of security.

The key features of Bluetooth technology are iniquitousness, low power and low cost. The Bluetooth specification defines a uniform structure for a wide range of devices to connect and communicate with each other.

VIII. Work Situation:

1. Faculty will demonstrate the use of Bluetooth and perform comparative analysis to transfer an image,audio and video file.
2. Faculty must form a group of two students.
3. Students group will use Bluetooth and perform comparative analysis.

IX. Resources required (Additional)

Sr. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Bluetooth enabled Mobile phone	Any basic phone having Bluetooth device	02	

X. Precautions to be followed

1. Check the battery status before connecting.
2. Enter correct password for pairing.
3. Disconnect the connection after usage.

XI. Procedure

(Note: This Procedure may vary phone to phone)

1. In Bluetooth and other devices settings, select send or receive files via Bluetooth.
2. In Bluetooth File Transfer, select send files.
3. Choose the device you want to share to.
4. Next. Select Browse.
5. The file or files to share.
6. Open, next to send it and finish.

XII. Observations:

Device A ⟶ Bluetooth Version 4.2 device
Device B ⟶ Bluetooth Version 4.2 device
Type of File : Image (.jpg)
File size =_____ MB
Initial Battery Level : Device A (MI A1)= ___% and Device B (Micromax)= ___%

Table 1

Sr. No.	Distance (Feet)	Time required for transmission from Device A → Device B (secs)	Battery Level	
			Device A (MI A1)	Device B (Micromax)

Type of File : Audio
File size =____MB
Initial Battery Level : Device A (MI A1)=___% and Device B (Micromax)= ___%

Table 2

Sr. No.	Distance (Feet)	Time required for transmission from Device A →Device B (secs)	Battery Level	
			Device A (MI A1)	Device B (Micromax)

Type of File : Video
File size = ___MB
Initial Battery Level : Device A (Moto G4+)= __% and Device B (LG K10)= __%

Table 3

Sr. No	Distance (Feet)	Time required for transmission from Device A → Device B (secs)	Battery Level	
			Device A (MI A1)	Device B (Micromax)

XIII. Graph

- Plot graph by taking distance in feet on x-axis and time in seconds on Y-axis also
- Plot graph by taking distance in feet on x-axis and battery % on Y-axis for image,audio and video.

XIV. Results

File type	**Average data rate (calculated)**	**Average data rate as per specifications**
Image		
Audio		
Video		

File type	**Maximum Range (As per experimentation)**	**Maximum Range as per specifications**
Image		
Audio		
Video		

XV. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. Define Bluetooth Technology and What are the features of Bluetooth Technology.
2. List classification of Bluetooth.

3. State basic principle and principle of operation involved in Bluetooth Technology.
4. Draw functional block diagram and frequency band, spread spectrum of Bluetooth.
5. State advantages. Disadvantages and Applications, specifications of Bluetooth Technology.

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XVI. Exercise

Note: Faculty must ensure that every group of students performs the exercise.

(Use blank space for answers or attach more pages if needed)

Build a Personal Area Network of mobile devices using Bluetooth Technology.

Setup Diagram:

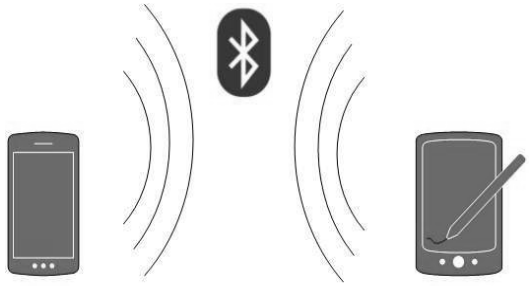

Figure 1:Personal Area Network using Bluetooth Technology

Observe the following setting and attach the screenshots of the mobile phone.

1. Setting Menu
2. Turning on the Bluetooth Tethering
3. Available Bluetooth devices
4. Successful Tethering Connection

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XVII. References / Suggestions for further Reading

1. https://electronicsforu.com/resources/cool-stuff-misc/gsm-at-commands
2. http://www.dignited.com/31936/how-to-create-a-bluetooth-pan-personal-area-network-on-android/
3. https://en.wikipedia.org/wiki/personal_area_network

XVIII. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1.	Connection procedure for setting up a network	20%
2.	Use of Bluetooth as a Personal area Network	30%
3.	Follow ethical practices	10%
Product related (10 Marks)		**40%**
4.	Observations and recording	20%
5.	Answer to sample questions	15%
6.	Timely Submission of report	05%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No.4: Configure Wi-Fi setting in mobile devices using mobile tethering.

I. Practical Significance

Mobile tethering allows us to share cellular data connection with others over Wi-Fi, Bluetooth or USB. Although the technology is ready and has promising outcomes, service providers and the users still keep their distance.

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II. Relevant Program Outcomes (POs)

PO 1. Basic knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the problems related to application of computers and communication services in storing, manipulating and transmitting data, often in the context of business or other enterprise.

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency **"Maintain Wireless and Mobile Networks".**

1. Configure Wi-Fi setting in mobile device.
2. Start mobile tethering for connect other wireless devices.

IV. Relevant Course Outcome(s)

Maintain Wireless network Technologies.

V. Practical Outcome(PrOs)

Configure Wi-Fi setting in mobile devices using mobile tethering to connect two devices such as mobile phone to mobile phone and mobile phone to laptop.

VI. Relevant Affective Domain Related Outcome(s)

1. Follow precautionary measures.
2. Demonstrate working as a leader / a team member.
3. Follow ethical practices.

VII. Minimum Theoretical Background

Tethering, or phone-as-modem (PAM) ,is the sharing of a mobile device's Internet connection with other connected computers. Connection of a mobile device with other devices can be done over wireless LAN (Wi-Fi),over Bluetooth or by physical connection using a cable. If tethering is done over WLAN, the feature may be branded as a personal or mobile hotspot, which allows the device to serve as a portable router. Mobile hotspots may be protected by a PIN or password. The Internet-connected mobile device can act as a portable wireless access point and router for devices connected to it. Mobile tethering performance results indicate that more people can access the Internet while they are mobile even if they do not have cellular data

subscription. More Internet based services can be offered to people while they roam in other countries. Tethering is the practice of using a mobile device (such as a smartphone) as a modem to connect another device, such as a laptop or another mobile phone to the Internet. To do so, the phone must have mobile data enabled.

VIII. Work Situation:

a. Faculty will demonstrate the configuration for Wi-Fi settings and mobile tethering and connect another mobile phone to the internet.
b. Faculty must form a group of two students.
c. Students group will use mobile phone for create mobile hotspot and connect two or more mobile devices to the Internet.

IX. Resources required (Additional)

Sr. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Wi-Fi enabled Mobile Phone	Any basic phone having Bluetooth device.	2	

X. Precautions to be followed

1. Check the battery status before connecting.
2. Enter correct PIN or password for connecting mobile hotspot.
3. Disconnect the connection after usage.

XI. Procedure

Share a mobile connection by tethering or hotspot(Using Android Device)

1. Open your phone's setting app.
2. Select Personal Hotspot.
3. Select Wi-Fi Hotspot.
4. Turn ON Wi-Fi Hotspot.
5. To see or change a hotspot setting. like the name or password, tap it. If needed, first tap set up Hotspot configuration.
6. Open Wi-Fi in another phone and select created hotspot.

XII. Observations

Observe and write the table contents.

Table 1: Contents of Mobile Device

Mobile Manufacturing	Mobile OS	Username and Password of hotspot

XIII. Result

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XIV. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. Write the steps for Wi-Fi configuration.

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2. Write a Wi-Fi Version used in hotspot.

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XV. Exercise

(Use blank space provide for answers or attached more pages if needed)

1. Connect the mobile hotspot to laptop
2. Connect the laptop hotspot to mobile without any password.

(Space for answers)

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XVI. References / Suggestions for further Reading

1. https://support.google.com/android/answer/9059108?hl=en(As on 20/08/2019)

XVII. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Use Mobile Tethering Technique	10%
2	Selection of personal and Wi-Fi Hotspot	10%
3	Open Wi-Fi in another phone and select created hotspot	40%
Product related (10 Marks)		**40%**
4	Practical related questions and exercise	10%
5	Completion and submission of practical in time	10%
6	Expected Output/Observation	20%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 5: Apply RFID technology for real life applications using RFID kit.

I. Practical Significance

RFID, Radio Frequency Identification is a technology ,which includes wireless data capture and transaction processing. Proximity (short range) and Vicinity (long range) are two major application areas where RFID technology is used. Track and trace applications are long range or vicinity applications. Various real time applications include asset tracking, people tracking, library, attendance system.

II. Relevant Program Outcomes (POs)

PO 1. Basic knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the problems related to application of computers and communication services in storing, manipulating and transmitting data, often in the context of business or other enterprise.

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

III. Competency and Skills

This practical is expected to develop the following skills for industry identified Competency **"Maintain Wireless and Mobile Network".**

1. Use RFID card.
2. Use RFID card for real time application.

IV. Relevant Course Outcome(s)

Test RFID reader detector.

V. Practical Outcome(PrOs)

Construct a simple RFID application.

VI. Relevant Affective Domain Related Outcome(s)

1. Follow precautionary measures.
2. Demonstrate working as a leader / a team member.
3. Follow ethical practices.

VII. Minimum Theoretical Background

Components of RFID System:

RFID system consists of three components RFID tag, reader, microcontroller.

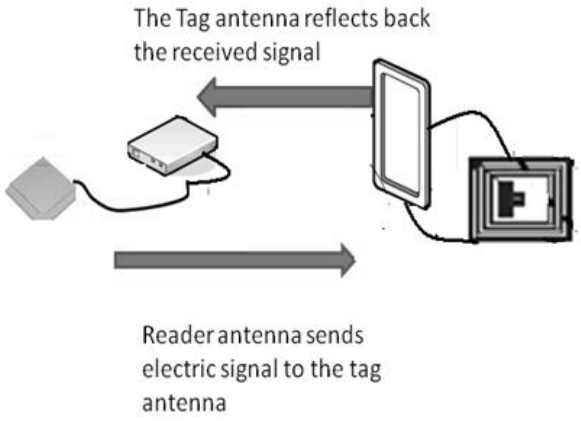
A RFID tag: It consists of a silicon microchip attached to a small antenna and mounted on a substrate and encapsulated in different materials like plastic or glass veil and with an adhesive on the back side to be attached to objects.

A reader: It consists of a scanner with antennas to transmit and receive signals and is responsible for communication with the tag and receives the information from the tag

Processor or a Controller: It can be a host computer with a Microprocessor or a microcontroller which receives the reader input and process the data.

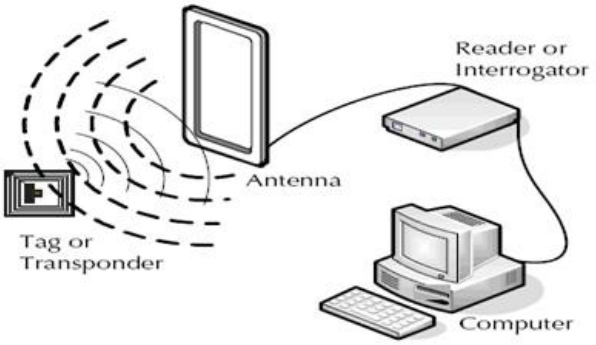
Types of RFID Systems: Active and Passive

Passive RFID system using EM wave propagation method: The antenna present in the reader transmits electromagnetic waves which are received by the antenna present in the tag as potential difference across the dipole. This voltage is rectified and filtered to get the DC power. The receiver antenna is kept at different impedance which causes it to reflect a part of the received signal. This reflected signal is received by the reader and monitored accordingly.



Active RFID system:

In the active RFID system, the reader sends signal to the tag using an antenna. The tag receives this information and resends this information along with the information in its memory. The reader receives this signal and transmits to the processor for further processing.



RFID Reader detector circuit:

RFID readers transmit an electromagnetic (EM) field with their reader antenna. This EM field induces a current in the antenna for all RFID tags within reading distance. This induced current activates the RFID chip that is connected to the tag's antenna. This chip then modulates a response (usually the unique ID number)that is transmitted back to the reader. The antenna of an RFID tag is usually a thin copper wire that is arranged in loops. The loops allow the emitted EM field of the RFID reader to induce current to the antenna of the tag.

VIII. Work Situation:

a. Faculty will demonstrate the working of RFID reader detector circuit.
b. Faculty must form a group of two students.

IX. Resources required (Additional)

Sr. No.	Instrument /Components	Specification	Quantity	Remarks
1.	RFID Trainer kit			
2.	RFID reader	Operating frequency 13.56 MHz		

X. Precautions to be followed

1. Handle RFID system and peripherals with care.

XI. Procedure

a. Connect the capacitor (82 pF) and the low current LED to the tag. They are connected in parallel. Also solder these two components to the copper tape to test RFID tags we need an RFID reader that can operate at a frequency of 13.56MHz.
b. Replace the connected capacitor and LED from our tag with an RFID chip (eg. the MIFARE 1k).By doing this, the activity of our tag is no longer visible through the LED, but our tag is then readable by the RFID reader and responds with the unique ID number of the chip.
c. With these simple steps, RFID reader detector testing is finished by bringing our DIY RFID detector close to an RFID reader),the connected LED lights up
d. If there are RFID readers available with a stronger EM field and therefore a higher maximum reading distance.

XII. Resources used (Additional)

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XIII. Observations

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XIV. Results

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XV. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. How does change in the length of antenna affect reading distances?

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2. State the operating frequency of RFID reader used.

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3. It is desired to make a database of the students in a college present at any particular day. Explain the approach to maintain and check a database for students of the college with RFID technology.

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XVI. Exercise

(Use blank space provide for answers or attached more pages if needed)

1. Write the working of RFID reader detector.
2. State applications of RFID.
3. Design & develop the program to display the card No on the LCD according to card swapped based on application of RFID.
4. Design & develop the program to ON/OFF the Relay and Buzzer according to the card swapped based on application of RFID.

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XVII. References / Suggestions for further Reading

1. https://www.elprocus.com/rfid-basic-introduction-simple-application/

XVIII. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Connecting components	20%
2	Obtaining results	20%
3	Understanding knowledge of RFID	20%
Product related (10 Marks)		**40%**
4	Practical related questions and exercise	20%
5	Completion and submission of practical in time	10%
6	Expected Output/Observation	10%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 6: Establish seamless wireless connectivity using multiple access point

I. Practical Significance

Seamless wireless connectivity can be interpreted as the process move between wireless networks for communication takes place when not distracted or without re-authentication. The process includes seamless roaming services in the most seamless work by using Internet Protocol (IP) that is designed to provide mobility at the network level connection.

II. Relevant Program Outcomes (POs)

PO 1. Basic knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the problems related to application of computers and communication services in storing, manipulating and transmitting data, often in the context of business or other enterprise.

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency **"Configure wireless network using multiple access points".**

1. Configure wireless access point.
2. Connect wireless devices to access point.

IV. Relevant Course Outcome(s)

Maintain wireless network Technologies.

V. Practical Outcome(PrOs)

Establish seamless wireless connectivity using multiple access point.

VI. Relevant Affective Domain Related Outcome(s)

1. Follow precautionary measures.
2. Demonstrate working as a leader / a team member.
3. Follow ethical practices.

VII. Minimum Theoretical Background

A wireless Access point (WAP) is a networking device that allows wireless-capable devices to connect to a wired network. Instead of using wires and cables to connect every computer or device in the network, installing WAPs is a more convenient, more secure, and cost-efficient alternative. In other words, the network itself continues to hold the user's IP address and get away from the connection to the other connection types, exchanged so smooth that there is no noticeable effect on the user side. If there are some areas in a room covered by more than one access point, then the cell coverage have to overlap. Each wireless station will automatically determine the best

connection will arrest of an Access point. Area coverage overlapping an important attribute of the WLAN setting because it enables seamless roaming between overlapping cells.

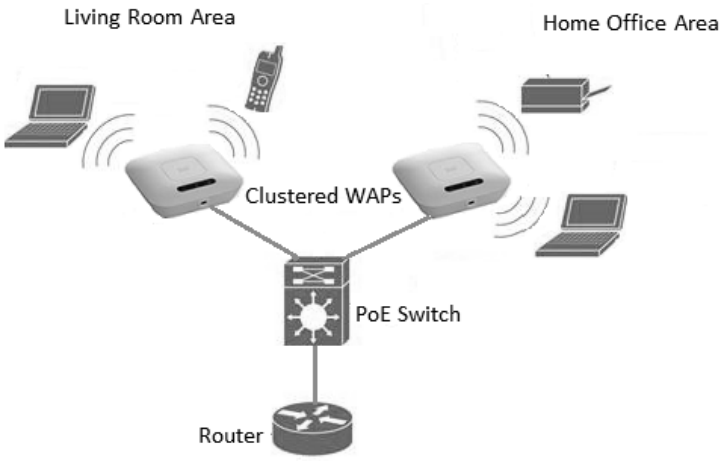

Figure 1: Seamless wireless access point

VIII. Work Situation:

a. Faculty will demonstrate the configuration for two or more access point with internet connection.
b. Faculty must form a group of two students.
c. Students group will use mobile phone,laptop for create seamless wireless connectivity using internet connection/LAN network.

IX. Resources required (Additional)

Sr. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Mobile Phone, Laptop			

X. Precautions to be followed

1. Handle access point, router, laptop, mobile, computer system and peripherals with care.
2. Shut down PC properly.

XI. Procedure

a. Configure two access point/routers (as access point) to use the same SSID and password.
b. Disable DHCP and NAT on the router (bridged).This will prevent the router form making a secondary network inside the existing network.
c. Assign an IP address to the router. If primary router has the IP address 192.168.1.1 give 192.168.1.2 to secondary router.
d. Finally give both Wi-Fi networks the same name(SSID)and set them to use the same password.
e. Once configured, devices connected to our Wi-Fi network will automatically switch between routers when needed.
f. When we move out of the range of my primary router, mobile phone, laptop, iPhone, iPad switches to the secondary one. It works perfectly.

XII. Resources used (Additional)

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XIII. Observations

Table 1:Contents of seamless Wireless Network

Access Point manufacturing	Range	Username and Password of Hotspot

XIV. Result

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XV. Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. Write how many access point used in seamless wireless network.
2. Write IP address and MAC address of access points.
3. Write name of SSID network.

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XVI. Exercise

(Use blank space provide for answers or attached more pages if needed)

1. Make your Own seamless wireless network in computer lab and write steps.
2. Transfer file, images using your seamless wireless network.

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XVII. References / Suggestions for further Reading

1. https://www.savjee.be/2012/10/creating-one-WiFi -network-with-multiple-access-points/

XVIII. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Configure two or more multiple access point	20%
2	Proper Hands on	20%
3	Use Proper wireless technology	20%
Product related (10 Marks)		**40%**
4	Practical related questions and exercise	10%
5	Completion and submission of practical in time	10%
6	Expected Output/Observation	20%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 7: Use AT commands to understand working of 3G network using 3G mobile phone Trainer kit.

I. Practical Significance

The mobile phone now a days become a necessity for an individual. The mobile now a days becoming smarter and the interface with all other services and internet is become necessary. The increased data rates in GSM network, allows the user to use video calling, conferencing, camera related applications. This has now become integral part of mobile. To get acquainted with these features GSM AT commands are used. This practical will help the students to execute Advanced features of 3G/4G networks like video call and phone camera command.

II. Relevant Program Outcomes (POs)

PO 1- Basic knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the problems related to application of computers and communication services in storing, manipulating and transmitting data, often in the context of business or other enterprise.

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

PO 8- Individual and team work: Function effectively as a leader and team member in diverse/multidisciplinary teams.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency **'Maintain Wireless and Mobile Network'**

1. Identify the components on GSM modem and identify the commands for call control features as well as advance features such as video call and phone camera, Microphone, loudspeaker volume control of a 3G/4G mobile phone unit
2. Use GSM modem and identify various AT commands for different functions of 3G/4G GSM Mobile unit.

IV. Relevant Course Outcome(s)

Maintain wireless mobile application

V. Practical Outcome (PrOs)

1. Execute AT commands for call control in 3G/4G network.
2. Execute AT commands for video call and phone camera related commands in 3G/4G networks.
3. Execute AT commands for Microphone and Loudspeaker volume control related commands in 3G/4G networks.

VI. Relevant Affective Domain Related Outcome(s)

1. Maintain tools and equipment.
2. Demonstrate working as a leader / a team member.
3. Follow ethical practices.

VII. Minimum Theoretical Background

While EDGE fulfils the 3G specifications, most GSM.UMTS phones report EDGE ("2.75G") and UMTS("3G") functionality. The following standards are typically branded 3G:

The UMTS (Universal Mobile Telecommunication Service) system, first offered in 2001,standardized by 3GPP,used primarily in Europe, Japan, China (however with a different radio interface) and other regions predominated by GSM (Global Systems for Mobile)2G system infrastructure. The cell phones are typically UMTS and GSM hybrids. Several radio interfaces are offered ,sharing the same infrastructure:

The following common standards comply with the IMT-2000/3G standard:

EDGE, a revision by the 3GPP organization to the older 2G GSM based transmission methods, utilizing the same switching nodes, base station sites and frequencies as GPRS, but new base station and cell phone RF circuits. It is based on the three times as efficient 8PSK modulation scheme as supplement to the original GMSK modulation scheme. EDGE is still used extensively due to its ease of upgrade from existing 2G GSM infrastructure and cell-phones.

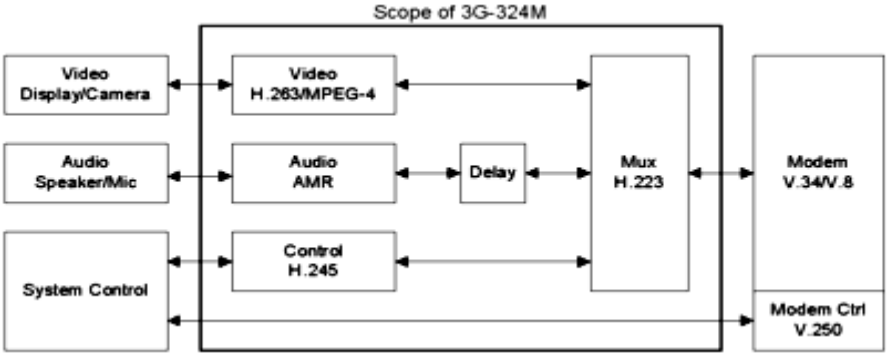

Figure 1: Block diagram of Video Call in 3G Mobile phone

(courtesy: https://en.wikipedia,org/wiki/3G-324M)

The 3G-324M protocol operates over an established circuit switched connection between two communicating peers. 3G-324M is an umbrella specification to enable conversational multimedia communication over Circuit Switched (CS) networks and has been adopted by the 3GPP. 3G-324M is based on the ITU-T H.324 specification for multimedia conferencing over Circuit switched networks. The 3G-324M specification using the Circuit switched network allows delay sensitive conversational multimedia services such as:

1. Videoconferencing for personal and business use
2. Multimedia entertainment services
3. Telemedicine
4. Surveillance
5. Live Video Broadcasting– Cable TV On-the-Go
6. Video-on-demand (movies, news clips)

VIII. Work Situation:

a. Faculty will demonstrate the use of Serial link control commands,Video call and phone camera related commands,General command,call control command and Microphone volume control commands and execute.
b. Faculty must form a group of two students.
c. Students group will practice Serial link control commands,Video call and phone camera related commands,General command,call control command and Microphone volume control commands and execute them.

Serial link control commands:

1. **ATS0**

The S0 parameter controls the automatic answering of an incoming call.
Concept Structure:

Command	Possible Response
ATS0=<n>	OK
ATS0?	<n>

Defined values:

<n>	Automatic answer after <n> rings.A value of 0 disables automatic answering.
Remarks	none
Source	GSM 07.07/V.25 ter/6.3.5
Implementation	complete

2. **AT+CR**

Command controls whether or not intermediate result code +CR:<serv> is returned from the modem during connect negotiation of a data call.
Concept Structure:

Command	Possible Response
AT+CR=[<mode>]	OK
AT+CR?	+CR:<mode>
AT+CR=?	+CR(list of <modes>s)

Defined values:

<mode>	
0	Disables reporting
1	Enables reporting
<serv> ASYNC	Asynchronous transparent
REL ASYNC	Asynchronous non-transparent
Remarks	none
Source	GSM 07.07/6.9
Implementation	complete

3. AT+CRC

Command controls whether or not the normal RING message of an incoming call is replaced by an extended call indication using unsolicited result code +CRING:<type>.
Concept Structure:

Command	Possible Response
AT+CRC=[<mode>]	OK
AT+CRC?	+CRC:<mode>
AT+CRC=?	+CRC(list of <modes>s)

Defined values:

<mode>	
0	Disables reporting
1	Enables reporting
<type>	
ASYNC	Asynchronous transparent
REL ASYNC	Asynchronous non-transparent
VOICE	Normal voice
Remarks	none
Source	GSM 07.07/6.11
Implementation	complete

4. AT+CCFC

Command is used to set the call forwarding service.

Concept Structure:

Command	Possible Response	
AT+CSAS	OK	+CME ERROR:<err>
AT+CSAS=?	OK	
Remarks	none	
Source	GSM 07.05/3.3.5	
Implementation	complete	

Video call and Phone camera Related commands:

1. AT+VPMAKE

The command is used to originate a video call. Before issue the command ,user can select video call TX source by AT+VPSOURCE and select whether record video after video call is connected or not by AT+VPRECORD.

Concept Structure:

Command	Possible Response
AT+VPMAKE=<num>	If connecting: VPACCEPT OK VPRINGBACK,VPSETUP,VPCONNECTED
ATS0?	If connecting: VPACCEPT OK VPEND

Defined values:

<num>	Dialing number, which must be less than 32 bytes.

2. AT+VPANSWER

The command is used to answer an incoming video call. If there is no incoming video call, OK response is given only.

Concept Structure:

Command	Possible Response
AT+VPANSWER	OK VPSETUP VPCONNECTED
	No incoming video call: OK

3. AT+VPEND

The command is used to end a video call. If recording video is ongoing, the command will stop recording and end video call. In addition, the command can be used to reject an incoming video call.

Concept Structure:

Command	Possible Response
AT+VPEND	Video call is connected: OK VPEND[:<seconds>]
	Video call is not connected: OK

Defined values:

<seconds>	The duration of video call, from VPCONNECTED to VPEND and the unit is in second.

4. AT+VPDTMF

The command is used to send DTMF tone during a connected video call, and it is sent s an H.245 user input indication (basic string) to the other side.

Note: The maximal length of DTMF string is 127.

Concept Structure:

Command	Possible Response
AT+VPDTMF=?	+VPDTMF (list of supported<vpdtmf>s) OK
AT+VPDTMF=<vpdtmf>	OK

Defined values:

<vpdtmf>	DTMF string consisted of (0-9,*,#)

5. AT+VPSOURCE

The command is used to select video TX source which provides video frames to transmit to remote party. If select video TX source before video call is connected, the Module will get video frames from specified TX source when video call is connected. The command is only effective on current or next video call.

Concept Structure:

Command	Possible Response
AT+VPSOURCE=?	OK
AT+VPSOURCE=<src>[,<frame>]	OK

Defined values:

<src>	The Module supports three TX sources-CAMERA, STATIC IMAGE and FILE SOURCE. In spite of which TX source is used, the size of video frames must be 176*144(pixel).
0	Send none image, video or video capture from camera
1	Capture video from camera (Default value)
2	Send a static image, support JPEG and BMP format
3	Send video frames from file, support MP4 and 3GP format
4	Reserved
5	Reserved

<fname>	Image or video file which is existed in current directory [refer to AT+FSCD],and it includes extension name

6. AT+CCAMS

The command is used to start camera. Make sure the sensor is existent and connect well. Camera must be started before taking picture or recording video.

Concept Structure:

Command	Possible Response
AT+CCAMS	OK
	If have no sensor: CAMERA NO SENSOR ERROR
	If camera has started: CAMERA INVALID STATE ERROR

7. AT+CCAME

The command is used to stop camera. If AT+CCAMTP has executed to take a picture and the picture is not saved by AT+CCAMEP, the picture will not be saved after AT+CCAME execution. If AT+CCAMRS has executed to record video and that is not ended by AT+CCAMRE, the video file will be stopped recording and saved after AT+CCAME execution.

Concept Structure:

Command	Possible Response
AT+CCAME	OK
	If camera has stopped: CAMERA NOT START , ERROR

Other Video call and phone camera Related commands:

1. AT+CLVL

This command is used to select the volume of the internal loudspeaker audio output of the device. Test command returns supported values as compound value.

Concept Structure:

Command	Possible Response
AT+CLVL=?	+CLVL(list of supported <level>s), OK
AT+CLVL?	+CLVL:<level>, OK
AT+CLVL=<level>	OK

Defined values:

<level>	Integer type value which represents loudspeaker volume level. The range is from 0 to 8,and 0 represents the lowest loudspeaker volume level,2 is default factory value.

Note:<level> is nonvolatile, and it is stored when restart.

2. AT+VMUTE

The command is used to control the loudspeaker to mute and unmute during a voice call or a video call which is connected. If there is not a connected call, write command can’s be used. When all calls are disconnected. the module sets the sub parameter as 0 automatically.

Concept Structure:

Command	Possible Response
AT+VMUTE=?	+VMUTE: (list of supported <mode>s), OK
AT+VMUTE?	+VMUTE:<mode>, OK
AT+VMUTE=<mode>	OK, ERROR

Defined values:

<mode>	
0	Mute off
1	Mute on

3. AT+CMUT

The command is used to enable and disable the uplink voice muting during a voice call or a video call which is connected. If there is not a connected call ,write command can’t be used. When all calls are disconnected, the module sets the sub parameter as 0 automatically.

Concept Structure:

Command	Possible Response
AT+CMUT=?	+CMUT:(list of supported <mode>s), OK
AT+CMUT?	+CMUT:<mode>, OK
AT+CMUT=<mode>	OK, ERROR

Defined values:

<mode>	
0	Mute off
1	Mute on

4. AT+CRSL

The command is used to select the incoming call ringer sound level of the device. The value of <level> will be saved to no volatile memory after write command is executed.

Concept Structure:

Command	Possible Response
AT+CRSL=?	+CRSL:(list of supported <level>s), OK
AT+CRSL?	+CRSL:<level>, OK
AT+CRSL=<level>	OK

Defined values:

<level>	Integer type value which represents the incoming call ringer sound level. The range is from 0 to 4,and 0 represents the lowest level ,2 is default factory value.

Note: <level>is nonvolatile and it is stored when restart.

General Command:

AT+GCAP: Request overall capabilities

Execution command causes the TA reports a list of additional capabilities.

Concept Structure:

Command	Possible Response
AT+GCAP=?	OK
Execution command	Responses
AT+GCAP	+GCAP:(list of <name>s), OK

Call Control Command:

ATO-Switch from command mode to data mode

ATO is the corresponding command to the +++ escape sequence. When there is a CSD call or a PS data call connected and the TA is in command Mode, ATO causes the TA to resume the data and takes back to data mode.

Concept Structure:

Command	Possible Response
ATO	TA/DCE switches to data mode from command mode: CONNECT
	If connection is not successfully resumed or there is not a connected CSD call: NO CARRIER

Microphone Volume Control:

AT+CMIC:

The command is used to control the microphone gain level. When the module restarts, the gain level will resume as default values. The setting will be saved to nonvolatile memory after write command is executed.

SIM: Not required

Concept Structure:

Command	Possible Response
AT+CMIC=?	+CMIC: (list of supported<gain Level>s), OK
Read command	Responses
AT+CMIC?	+CMIC:<gain Level>, OK
Write Command	Responses
AT+CMIC=<gain Level>	OK, ERROR

Defined values:
<gain level> : Range from 0 to 15 and 0 is the lowest gain level.
When the audio output of device is handset,14 is default value; when headset, 13 is default value; when speaker,4 is default value.
Examples

AT+CMIC=5
OK
AT+CMIC?
+CMIC:5
OK

(Note: Teacher can give more commands related to experiment)
Note: In any of the practical related to AT command this ”ERROR” can be the possible response which means: The device is not interfaced or available in MODEM. (This could be one of the reasons for getting this kind of error)

IX. Resources required

Sr. No.	Instrument /Components	Specification	Quantity	Remarks
1.	3G mobile phone Trainer Kit			
2.	3G activated SIM card(s) of any service provider supporting Tri-Band UMTS 2100/1900/850MHz Or 2100/1900/900MHz			
3.	Power Supply, Hands free kit, CRO/Spectrum Analyzer, Connecting wires, Antenna with coaxial cable, Micro SD Card			
4.	Computer system	A basic computer system with minimum configuration and operating system like windows 2000/xp/vista/2007/ 2010	01	
5.	GSM Modem	SIM 300 or higher	01	
6.	SIM Card	Any 3G network SIM card	01	
7.	Serial Cable	DB-9 serial connector	01	
8.	Adapter	12V DC	01	

X. Precautions to be followed

a. Insert SIM card properly.
b. Make sure the SIM is having network coverage.
c. Type the AT Commands after reading their use, as it might reset/Format the SIM Data.

XI. Procedure

Steps for connecting GSM Modem with Hyper terminal software:

a. Connect the setup as shown in the block diagram given below.

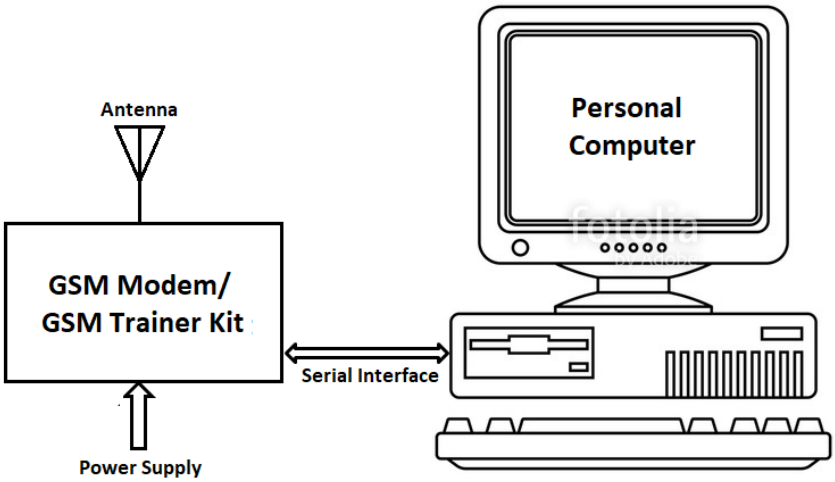

Figure 2 : Interfacing diagram of GSM modem and computer

b. Start the PC and load the required software for GSM modem/Trainer.
c. Start the Hyper terminal software.
d. Open File->New connection

Figure 3 : Screenshot of hyper terminal software

e. Set the COM1 properties with default values as:
   Speed/Baud rate:9600
   Data Bits:8
   Parity: None
   Stop Bit:1
   Flow Control: None
f. Type "AT" on the screen (command file) and detect connection by receiving response "OK".
g. Type the various commands and check their responses.
h. Record the responses of given various commands in the observation table.

XII. Student Activity (Additional)

(Teacher shall form group of 4 to 5 students and allot any one activity from the following)

1. Draw the block diagram of 3G mobile system.
2. Draw the screen format seen on LCD for the command AT+CCAMS.

XIII. Observations

Observe command response and write their Responses.

(Use blank sheet provided if space not sufficient)

Sr. No.	Command	Response

XIV. Questions for confirmation of learning:

1. What do you mean by the generations of the mobile communication networks?
2. State the basic blocks of 3G architecture model.
3. List the various 3G AT command.

(Space for answer)

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XV. Results

Observed the responses and results of AT commands

1. The response to the AT+VPMAKE is _____
2. The response to the AT+CCAMS is _____

XVI. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. Compare 2G and 3G network, GSM and GPRS.
2. State the advanced features of 3G communication.
3. How automatic selection of network is done?
4. How network availability is decided? what are the criteria to do so? How to improve network availability to the user?
5. What is the effect of antenna location in the cell, on the network availability?

(Space for answer)

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XVII. Exercise

(Use blank space provide for answers or attached more pages if needed)

1. Establish a video call between 2 phones and write the steps of video call process.
2. Write specifications of camera available in the phone.
3. Explain process of capturing an image in Mobile Phone Camera.
4. Test the microphone and speaker of the phone available in lab using specific code.(Search for code to diagnose the phone).

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XVIII. References / Suggestions for further Reading

1. https://electronicsforu.com/resources/cool-stuff-misc/gsm-at-commands.
2. http://www.falcom.de/uploads/media/A2D_hardware_description .pdf.
3. https://www.etsi.org/deliver/etsi_gts/07/0707/05.00.00_60/gsmts_0707v050000p.Pdf
4. https://en.wikipedia.org/wiki/3G-324M
5. https://www.mt-system.ru/sites/default/files/docs/simcom/docs/sim5215-16/simcom_sim5215_sim5216_atc_en_v1.21.pdf
6. www.mobilecomms-technology.com
7. www.gsmworld.com
8. www.sparkfun.com/datasheets/CellularModules/AT_Commands_Reference_Guide_r0.pdf
9. www.zeeman.de/wp-content/uploads/2007/09/ubinetcs-at-command-set.pdf

XIX. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Use of GSM modem with Hyper terminal Software	20%
2	Identifying AT Commands for an experiment	30%
3	Follow ethical practices	10%
Product related (10 Marks)		**40%**
4	Observations and recording	20%
5	Answer to sample questions	15%
6	Timely Submission of report	05%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 8: Check network availability manual and auto selection of network using AT commands.

I. Practical Significance

AT commands are used in GSM network. It works in two modes, user mode and AT command mode to understand working of Global System for Mobile communication. It also provides facility to study different signal like Transmission clock, Receiving clock, Buzzer, Vibrator, Voice, Sync and SIM Card indication in GSM Mobile Phone system. It is equipped with a keypad with Dedicated keys like: Alphabet, Numeric and function for user interaction.

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II. Relevant Program Outcomes (POs)

PO 1. Basic knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the problems related to application of computers and communication services in storing, manipulating and transmitting data, often in the context of business or other enterprise.

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

PO 8- Individual and team work: Function effectively as a leader and team member in diverse/multidisciplinary teams.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency **'Maintain Wireless and Mobile Network'**.

1. Understand the installation of GSM mobile phone and interpret various AT commands and their response.
2. Identify the network from the received list.
3. Ability to check the status of the signal strength and to select the AT commands for a specific selection.

IV. Relevant Course Outcome(s)

Maintain wireless mobile application

V. Practical Outcome (PrOs)

Check network availability manual and auto selection of network using AT commands.

VI. Relevant Affective Domain Related Outcome(s)

1. Maintain tools and equipment.
2. Demonstrate working as a leader / a team member.
3. Follow ethical practices.

VII. Minimum Theoretical Background

Prior Concepts of Block diagram of mobile communication system, Global System for Mobile (GSM) and working principle of GSM system should be known to students.

VIII. Work Situation

a. Faculty will demonstrate the use of AT Commands and execute.
b. Faculty must form a group of two students.
c. Students group will practice AT Commands and execute them.

1. Public Land Mobile Network (PLMN): It is mobile network available on Land.

2. AT+COPS: This command is used to show the current and the available PLMN's.It is also used to select a PLMN manually or automatically. Command is used to show the current and the available PLMN's.

Concept Structure:

Commands	Possible Responses
AT+COPS?	+COPS:0,0,"service provider name"

3. AT+CSQ: This command is used to ask for the network field strength and the current bit error rate.Command is used to ask for the networks field strength and the current bit error rate.

Concept Structure:

Commands	Possible Responses	
+CSQ	+CSQ:<rssi>,<ber>	+CME ERROR:<err>
+CSQ=?	+CSQ:(list of supported <rssi>s), (list of supported<ber>s)	

4. **AT+CREG:** This command is used to show the network registration status and to control the presentation of an unsolicited result code +CREG:<stat> when there is a change in the network registration status.

Concept Structure:

Commands	Possible Responses	
+CREG=[<n>]	OK	
Unsolicited result codes: +CREG:<stat> if <n> equals 1 +CREG:<stat>,<lac>,<ci> if <n> equals 2		
AT+CREG?	+CREG:<n>,<stat>(n=1) +CREG:<n>,<stat>,<lac>,<ci> (n=2)	+CME ERROR:<err>
AT+CREG=?	OK	

Defined values**:**

<n>:

0	Disable network registration unsolicited result code
1	Enables network registration code result code +CREG:<stat>
2	Enable network registration and location information unsolicited result code with +CREG:<stat>,<lac> and <ci>

<stat>:

0	Not registered, ME is not currently searching a new operator
1	Registered, home network
2	Not registered, but ME is currently searching a new operator
3	Registration denied
4	Unknown
5	Registered, roaming

<lac>: String type; two byte location area code in hexadecimal format (eg.00C3 equals 193 in decimal)

<ci>: String type; two byte cell ID in hexadecimal format
Remarks: none
Source: GSM 07.07/7.2
Implementation: Complete

IX. Work Situation

a. Faculty will demonstrate the use of AT Commands and execute.
b. Faculty must form a group of two students.
c. Students group will practice AT Commands and execute them.

X. Resources required

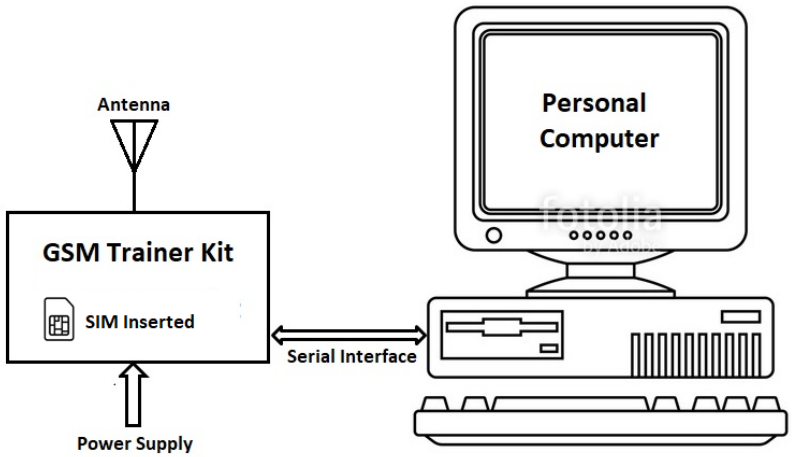
Sr. No.	Instrument /Components	Specification
1.	GSM Mobile phone Trainer kit	
2.	SIM card(s) of any GSM service provider supporting 900/1800 frequency band	
3.	Power supply	
4.	PC with Windows XP	
5.	RS 232 Interface	
6.	Operating Software for GSM trainer	

XI. Precautions to be followed

a. Insert SIM card properly
b. Make sure the SIM is having network coverage.
c. Type the AT commands after reading their use, as it might reset/Format the SIM Data

XII. Procedure

a. Connect the set up as shown in Figure below.



b. Insert SIM card before switching ON power supply.
c. Switch ON the power supply.
d. Start PC and load the software required for GSM trainer.
e. Locate the Hyper Terminal. It is generally available in Start->Programs->Accessories->Communication->Hyper Terminal
f. Open file->New Connection

g. Set the COM1 properties with default values as:
   Speed:9600
   Data Bits:8
   Parity: None
   Stop Bit:1
   Flow Control: None
h. Type ”AT” on the command line and detect connection by receiving response “OK”
i. Type the various AT Commands and checks their responses.
j. Record the responses of given various commands in the observation table.

XIII. Questions for confirmation of learning:

1. Why there is a need of AT+CREG?
2. What do you mean by dual band handsets?
3. How automatic selection of network is done?

(Space for answer)

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XIV. Observations

Observe Command response and write their Responses

Sr.No.	Command	Response

XV. Student activity

1. State the process of connecting hyper terminal with mobile trainer.
2. Draw the screen format seen on LCD for the command AT+COPS.
3. Draw the screen format seen on LCD for the command AT+CSQ.

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XVI. Results

Observed the response and results of AT commands

1. The response to the AT+COPS is_____(Location area no/location area name/Antenna no.)
2. The response to the AT+CSQ is _____ (signal strength in dBm/signal strength in %/Type of signal)

XVII. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. What values of signal strength are used in GSM network and CDMA network?
2. What happens if signal strength reduced beyond a certain minimum value?
3. How network availability is decided? what is the criterion to do so?
4. How to improve network availability to the user? Define bit error rate.
5. What is the effect of antenna location in the cell, on the network availability?

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XVIII. Exercise

(Use blank space provide for answers or attached more pages if needed)

Observe Command response and write their Responses

Sr. No.	Command	Response
1	AT+CTFR Call Deflection	
2	AT+CAOC Advice of Charge	
3	AT+CPLS Selection of Preferred PLMN List	
4	AT+CPOL Preferred PLMN List	
5	AT+CIMI Request International Mobile Subscriber Identity	

XIX. References / Suggestions for further Reading

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3. www.communica.se/multitech/gprs_at.pdf
4. www.sparkfun.com/datasheets/cellularModules/AT_Commands_Reference_Guide_r0.pdf
5. www.zeeman.de/wp-content/uploads/2007/09/ubinetics-at-command-set.pdf

XX. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Use of GSM Modem with Hyper terminal Software	20%
2	Identifying AT Commands for an experiment	30%
3	Follow ethical practices	10%
Product related (10 Marks)		**40%**
4	Observation and recording	20%
5	Answer to sample questions	15%
6	Timely Submission of report	05%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……...

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 9 : Simulate Bluetooth voice transmission to observe effect of AWGN & interference of 802.11b on transmission using MATLAB & Simulink.

I. Practical Significance

Bluetooth uses the unlicensed Instrumentation, Scientific, and Medical (ISM) band around 2.4GHz. It shares this channel with devices used for other applications including cordless phones, garage door openers, highway toll transponders, and outside broadcasting equipment. It is also susceptible to interference from microwave ovens, which emit radiation in this bandwidth.

II. Relevant Program Outcomes (POs)

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

PO8-Individual and team work: Function effectively as a leader and team member in diverse/multidisciplinary teams.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency "Maintain Wireless and Mobile Network".

1. Ability to measure the values and note down the observations.
2. Ability to follow systematic procedure or sequence of operation.

IV. Relevant Course Outcome(s)

Maintain wireless network Technologies.

V. Practical Outcome(PrOs)

To simulate Bluetooth voice model.

VI. Relevant Affective Domain Related Outcome(s)

1. Maintain tools and equipment.
2. Demonstrate working as a leader / a team member.
3. Follow ethical practices.

VII. Minimum Theoretical Background

Bluetooth Specifications:

The Bluetooth standard gives specifications for voice and data communication over a radio channel with a maximum capacity of 1Mbps. Here we will be looking at the design of the physical layer in Simulink. Operations such as link manager protocol and logical link control, which are better modeled as state machines in State flow are not considered here. Bluetooth transmits at a low power (1mW) and is therefore designed for short-range use of less than 10 meters. The modulation scheme used in Bluetooth is Gaussian Frequency Shift Keying (GFSK).

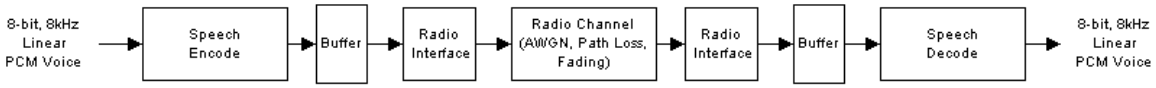


Figure 1: Communications link between transmitter and receiver for voice transmissions.

Figure 2 shows a more detailed block diagram of the transmitter only, including speech coding, whitening, Header Error Check (HEC), FEC, framing, modulation, frequency hopping, and RF subsystem.

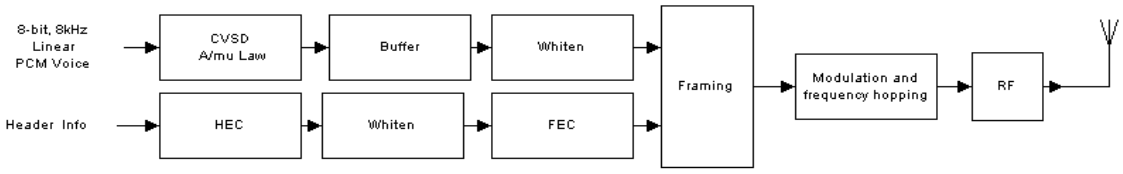


Figure 2 : Transmitter specification.

In Bluetooth, voice transmission is known as a Synchronous Connection Oriented (SCO) type of communication and transmits only every sixth slot.

VIII. Work Situation:

a. Faculty will demonstrate the use of MATLAB and simulink to simulate Bluetooth voice transmission.
b. Faculty must form a group of two students.
c. Students group will practice simulation of Bluetooth voice model.

IX. Resources required (Additional)

Sr. No.	Instrument /Components	Specification	Quantity	Remarks
1.	IBM PC Compatible Computer System	Suitable specifications as per requirement of simulation software with Latest Processor	1	
2.	Simulation Software	MATLAB Software		

X. Precautions to be followed

1. Ensure proper earthing to the computer system.
2. Ensure compatibility of computer system with software.
3. Ensure proper installation of simulation software.

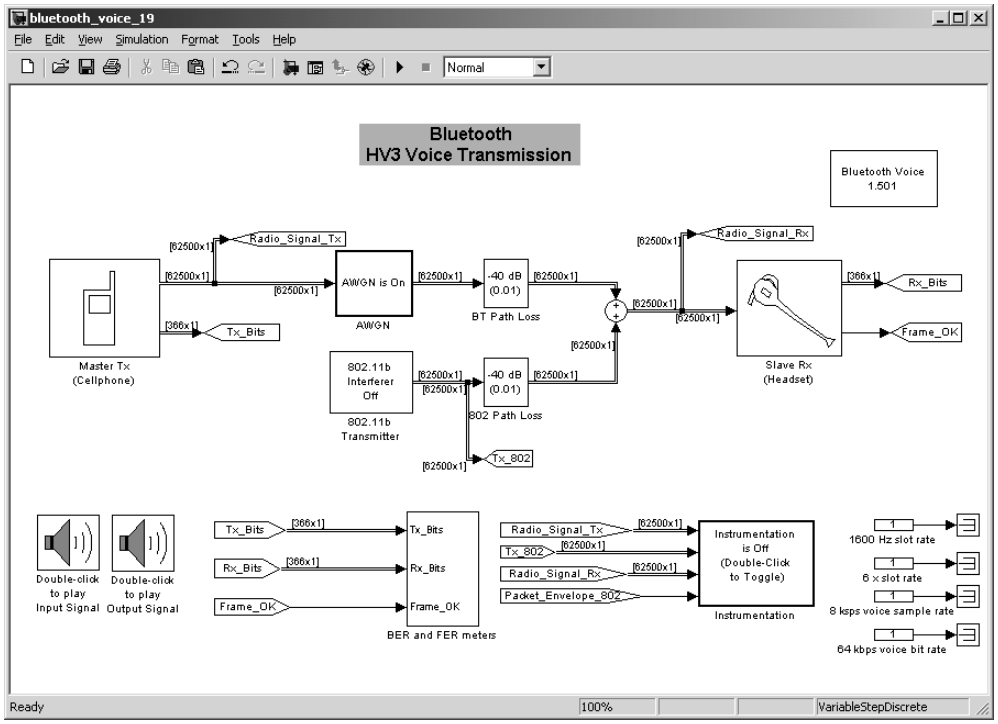
XI. Procedure

a. Switch on the computer and click on the MATLAB icon.
b. Go to start at the bottom of the command window, then select “simulink” then go to library browser and drag it into creating file.(or) Once you open the MATLAB

then click on simulink icon .Go to file and select new and then select model. You will get a new window.

c. Arrange the functional blocks as shown in simulink model.
d. Assign required parameters to each functional block.
e. Observe the outputs on scope.

XII. Simulink Model of Bluetooth voice Transmission



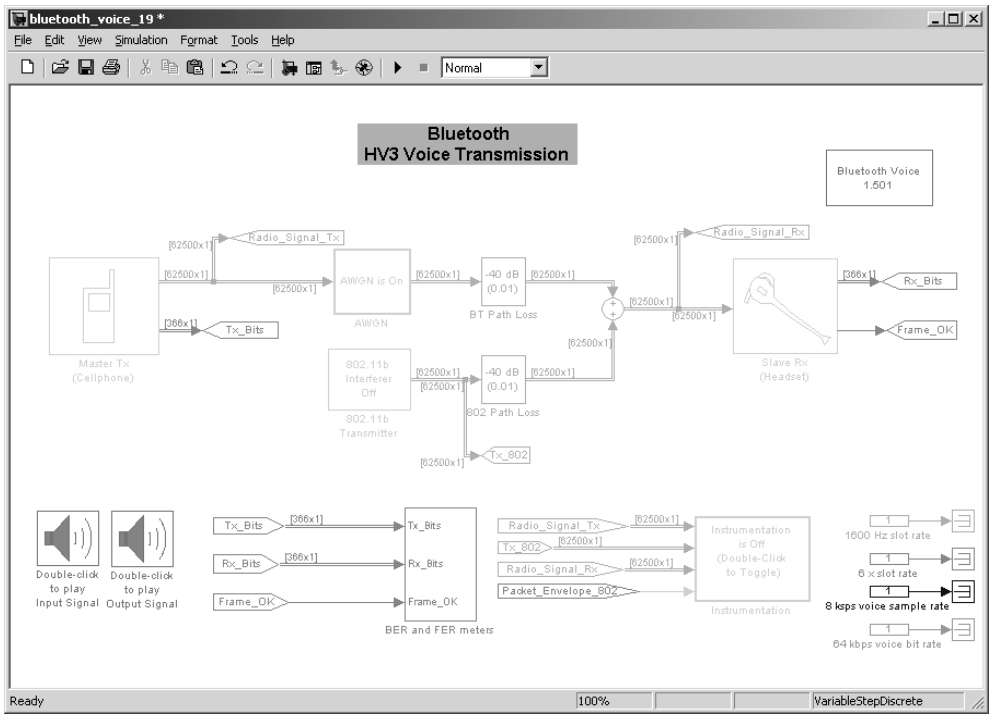


Figure 3 :The 'Sample-time Colors' option highlights the various model sample rates

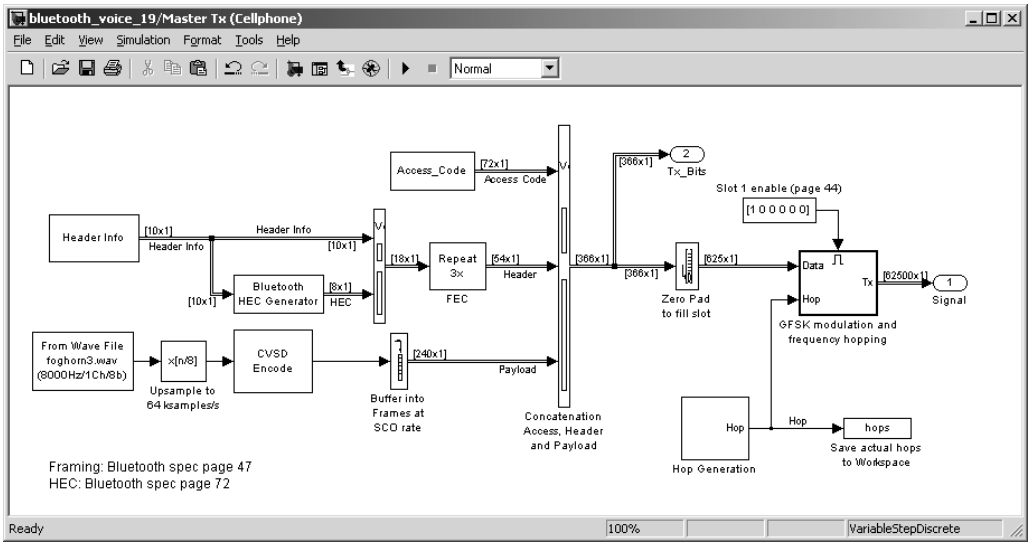


Figure 4 : Simulink transmitter subsystem

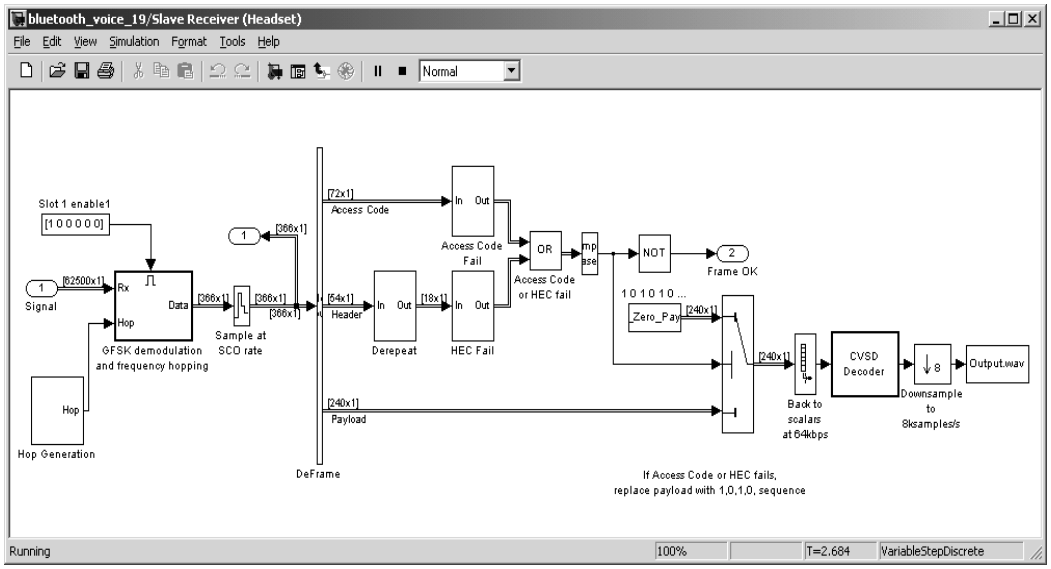


Figure 5: Simulink receiver subsystem

This demo models part of a Bluetooth® system. The demo uses frequency hopping a 79 MHz frequency range to avoid interference with other devices transmitting in the band. In this scheme, the sender divides transmission time into 625-microsecond slots, and uses a new hop frequency for each slot. Although the data rate is only 1 Mbps, a much larger bandwidth of 79 MHz is required to simulate the frequency hopping effects. The Bluetooth model contains the following elements:

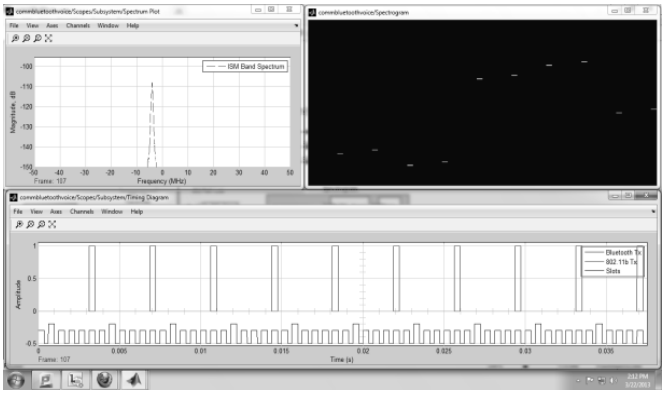
- Master transmitter
- Radio channel
- IEEE® 802.11b interferer
- Slave receiver
- Bit error rate (BER) display
- Scopes

The transmitter subsystem performs speech coding, buffering, framing, header error control (HEC), forward error correction (FEC), GFSK modulation, and frequency hopping. Channel effects modelled include thermal noise, path loss, and interference.

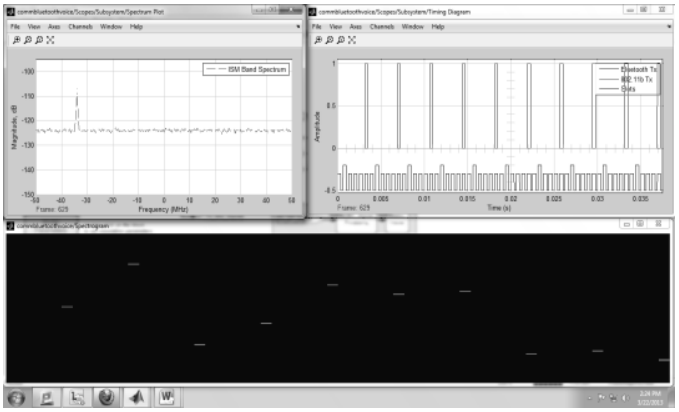
The Free Space Path Loss block, from the RF Impairments library, models path loss. The IEEE 802.11b interferer is a masked subsystem that opens up a mask dialog for user input on double-clicks. Mean packet rate, packet length, power, and frequency location in the ISM band can be specified in the dialog. The Slave Receiver recovers speech from the transmitted signal, performing all the complementary operations that the transmitter does, but in reverse order.

XIII. Simulation Output

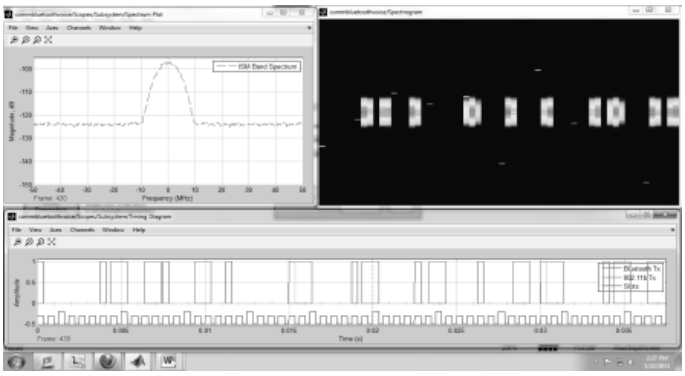
CASE 1: AWGN off and 802.11 off



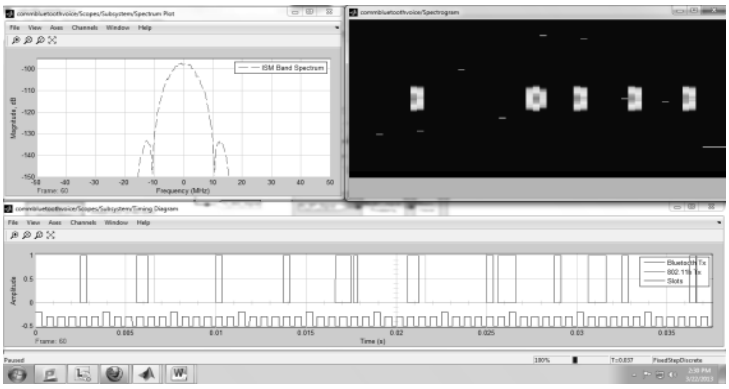
CASE 2: AWGN on and 802.11 off



CASE 3: AWGN on and 802.11 on



CASE 4: AWGN off and 802.11 on



XIV. Actual Simulink Block Diagram & Output Observed

(Students should paste the simulink block diagram and Simulation Output)

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XV. Conclusion

Effect of AWGN and of Interference of 802.11b on transmission.

CASE 1: AWGN off and 802.11 off

In this case, as shown in the graph , there are no interferer slots because WLAN interferer is off.

CASE 2: AWGN on and 802.11 off

In this case, as shown in the graph , there are no interferer slots because WLAN interferer is off.

CASE 3: AWGN on and 802.11 on

In this case, as shown in the graph , there are maximum interferer slots because WLAN interferer and AWGN is on.

CASE 4: AWGN off and 802.11 on

In this case, as shown in the graph ,there will be little interferer slots because WLAN interferer is on and AWGN is off**.**

XVI. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. Explain CVSD Speech coding in Bluetooth voice transmission.

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2. Explain Modulation and frequency hopping in Bluetooth voice transmission.

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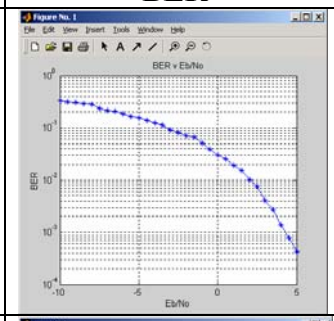
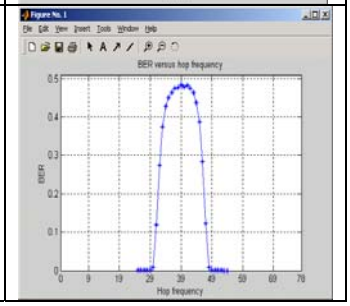
XVII. Exercise

(Use blank space for answers or attach more pages if needed)

1. Test following results and analyze the performance.

802.11 b	AWGN	Hop Frequency	BER
Off	E_b/N_o =1:1:15	Random	
Packet Rate=999 (Fixed On)	Off	0:78	

(Space for answers)

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XVIII. References / Suggestions for further Reading

1. www.read.pudn.com/downloads183/sourcecode/comm/.../Bluetooth%20Voice.d...

XIX. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1.	Handling of Simulation software and working in team	20%
2.	Building of diagram and Simulation output	30%
3.	Measuring values from PC Screen	10%
Product related (10 Marks)		**40%**
4.	Observations and recording	20%
5.	Answer to sample questions	15%
6.	Timely Submission of report	05%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 10: Develop a mobile application for wireless technology using any wizards such as available on www.appypie.com or any other.

I. Practical Significance

Creating own app is a powerful way to marketing business. A good app will get excellent results for business.

II. Relevant Program Outcomes (POs)

PO 1. Basic knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the problems related to application of computers and communication services in storing, manipulating and transmitting data, often in the context of business or other enterprise.

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency "Maintain Wireless and Mobile Network".

1. Appy Pie delivers a rich user interface for a mobile application by using HTML5 with JavaScript and CSS.

IV. Relevant Course Outcome(s)

Maintain wireless mobile application.

V. Practical Outcome(PrOs)

To develop a mobile application for wireless technology.

VI. Relevant Affective Domain Related Outcome(s)

1. Demonstrate working as a leader / a team member.
2. Follow ethical practices.

VII. Minimum Theoretical Background

Appy Pie is a mobile app platform released on Android and iOS platforms. It is an app that allows its users to create different types of mobile apps, which can then be released to the public and monetized. It also features its own marketplace to show off apps created through it. Appy Pie launched out of beta version of its WYSIWYG mobile app creation service on 14 April 2013. Appy Pie delivers a rich user interface for a mobile application by using HTML5 with JavaScript and CSS. Using Phone GAP API user interfaces can be created with JavaScript component libraries that render interactive user interface widgets using HTML5 elements.

VIII. Work Situation:

a. Faculty will demonstrate the use of wizard such as www.appypie.com for developing mobile application.
b. Faculty must form a group of two students.
c. Students group will perform mobile application development.

IX. Resources required

Sr. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Hardware: IBM PC Compatible Computer System			
2.	Any other resource used:www.appypie.com			

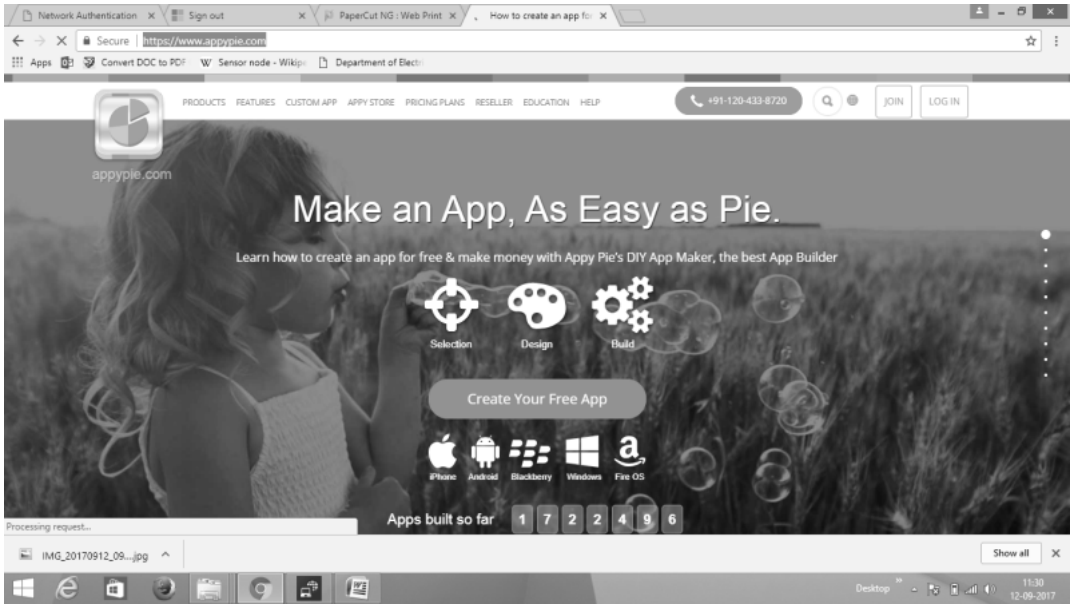
X. Precautions to be followed

1. Create Login id and password carefully.
2. Follow stepwise procedure and Shut down PC properly after performing.

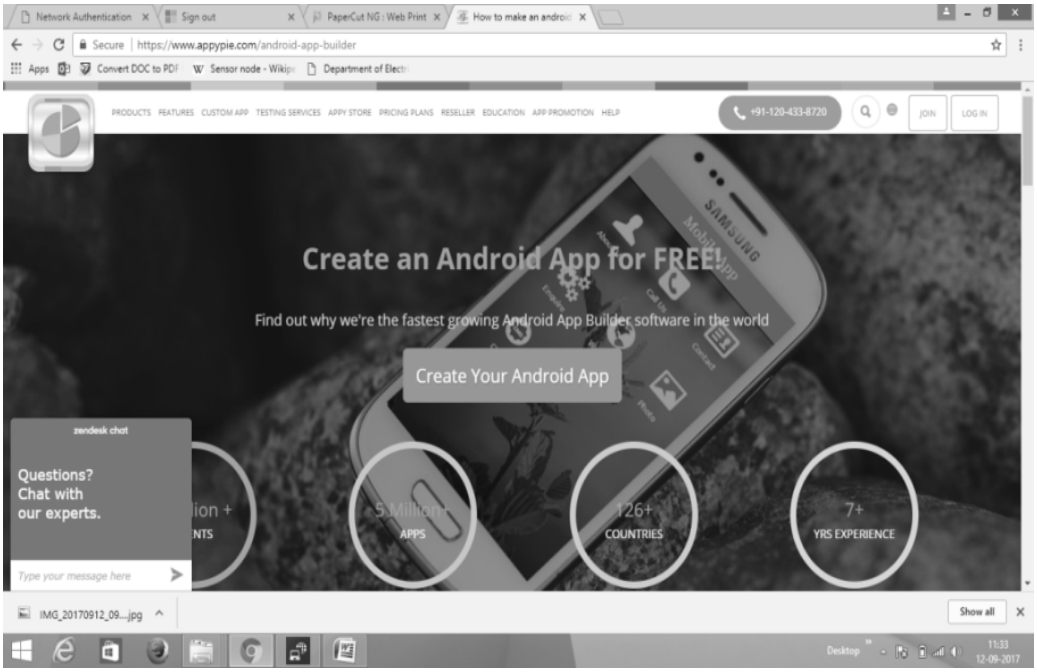
XI. Procedure

7. Open www.appypie.com or any App building software. It involves 3 main steps
1. Select
2. Build
3. Publish

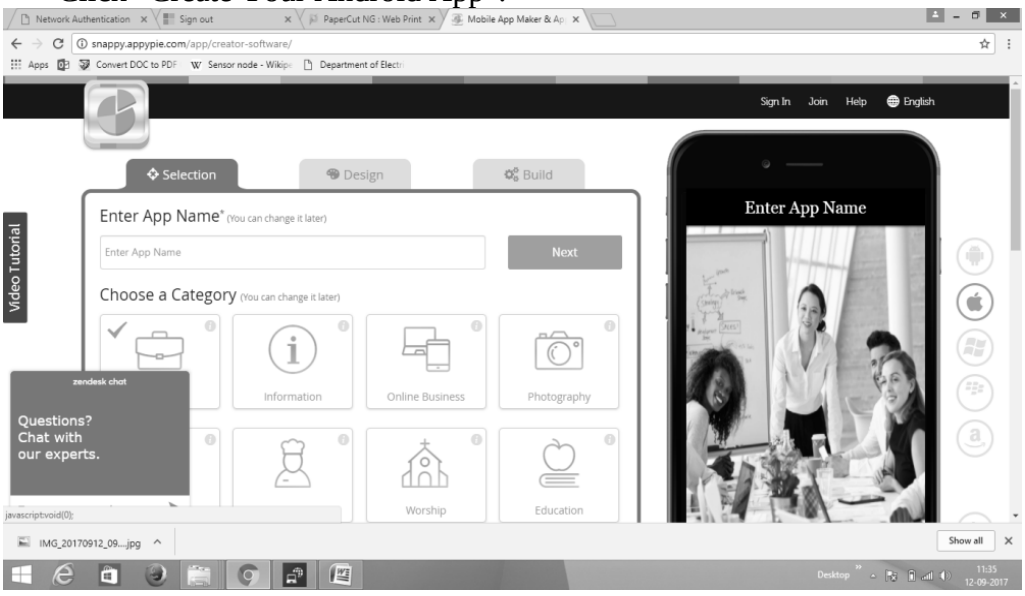
- Click on Login: Create Login id and password and then proceed.



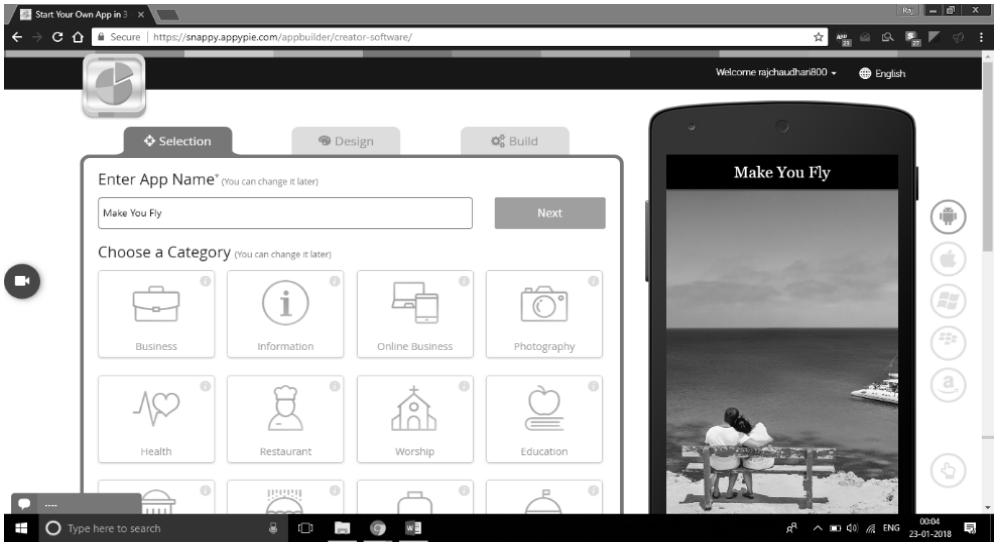
- Select an operating system.
- Click on “Android”.



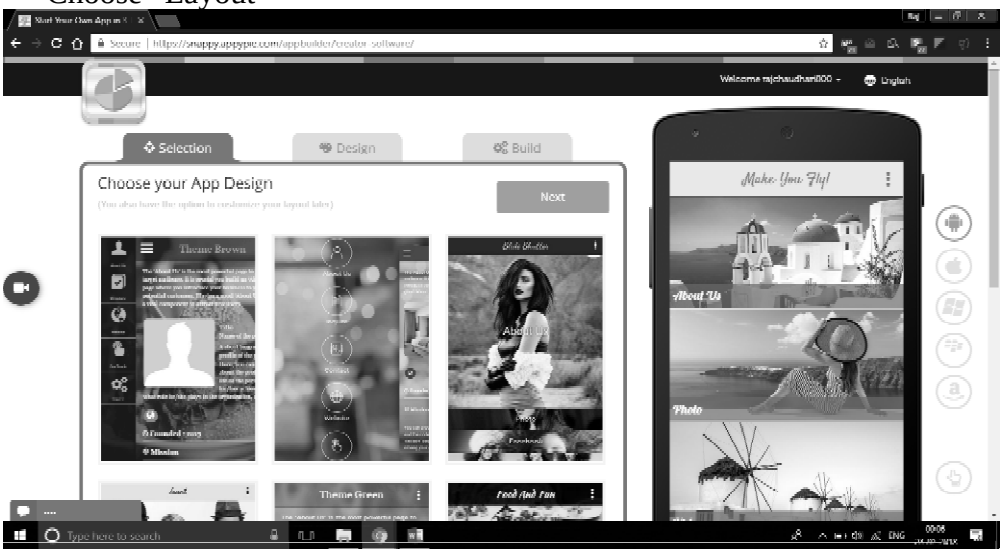
- Click “Create Your Android App”.



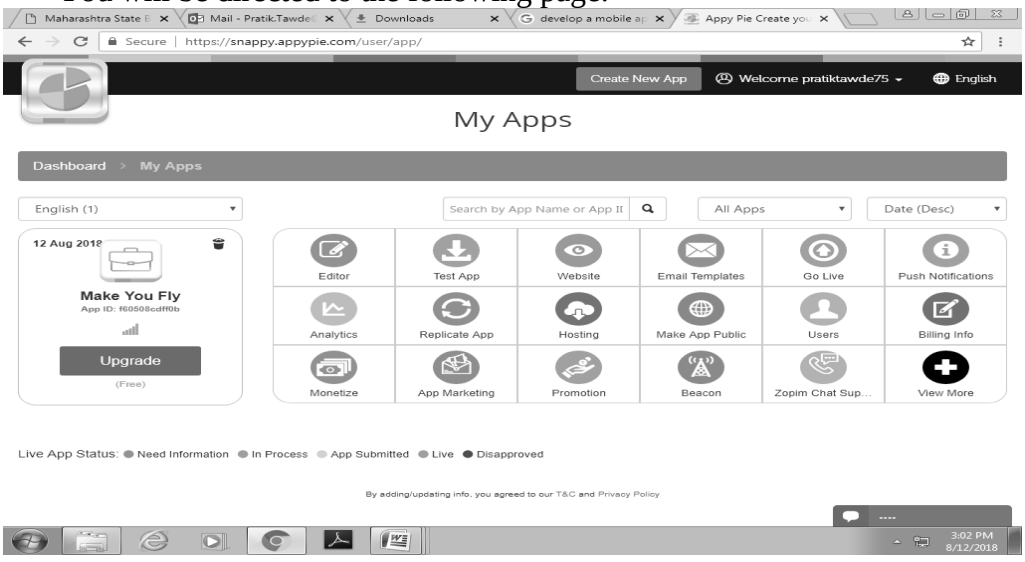
- Enter App Name Eg: Make You Fly
- Choose Category: Example: Travel



- Click Next. then You will be directed to “Enter your Facebook Page name “This is optional field”.You can skip it.
- Click “Next”. You will be directed to following page:
- Choose “Layout”

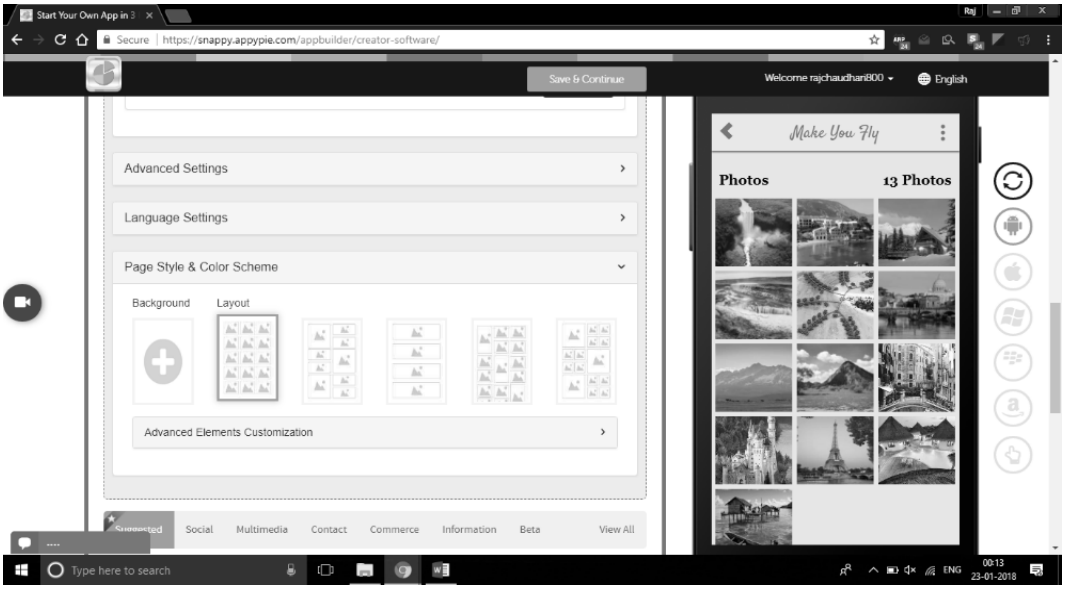


- Click “Next”.
- You will be directed to the following page:

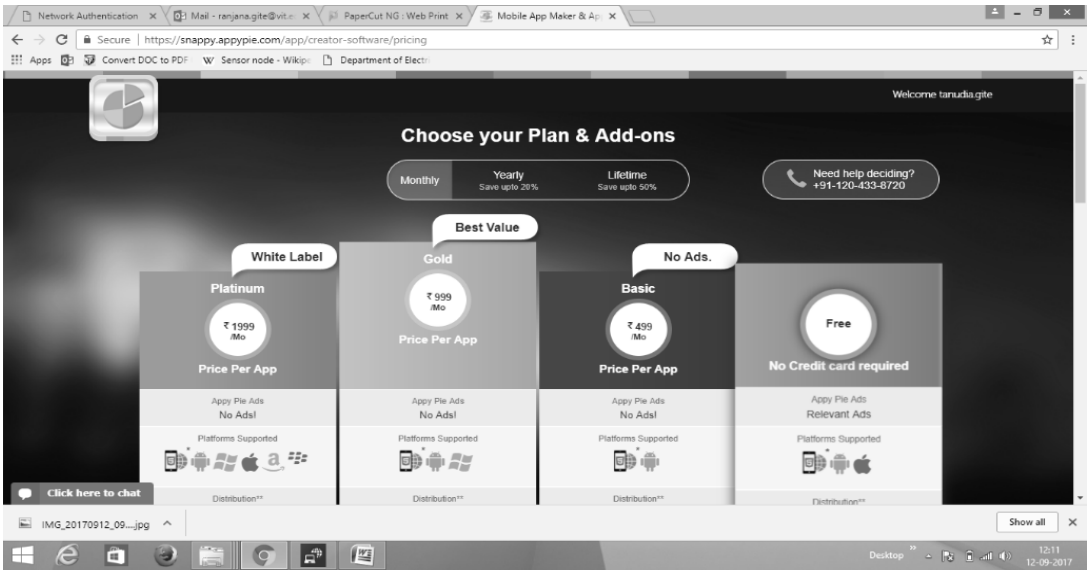


- You can select the number of pages of your App.

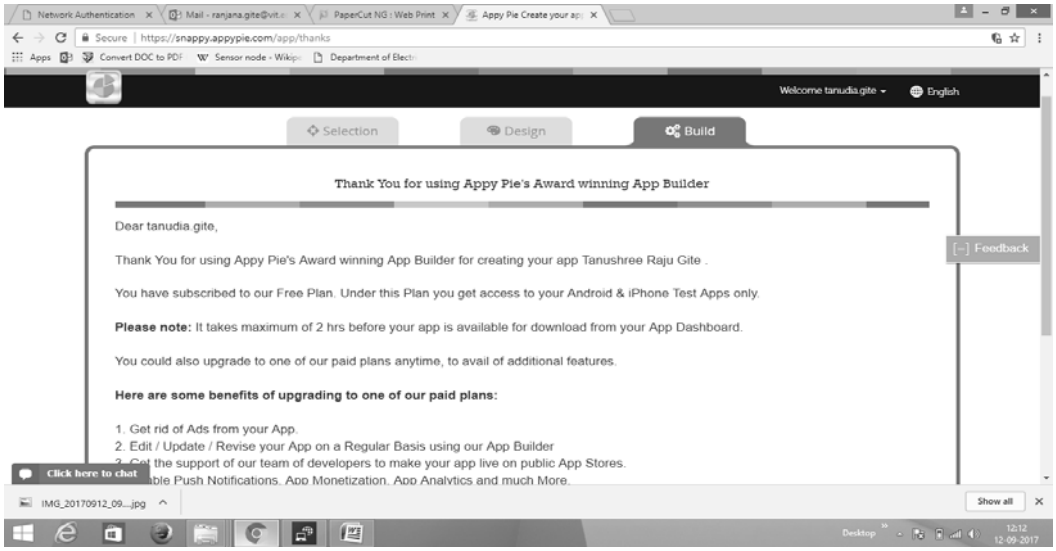
- You can change the page name.
- You can add Description either by Typing the contents or from the websites.
- You can add or delete or change related details as per your App requirements.
- You can change “Page style and color scheme”.
- Click on “SAVE and FINISH”.



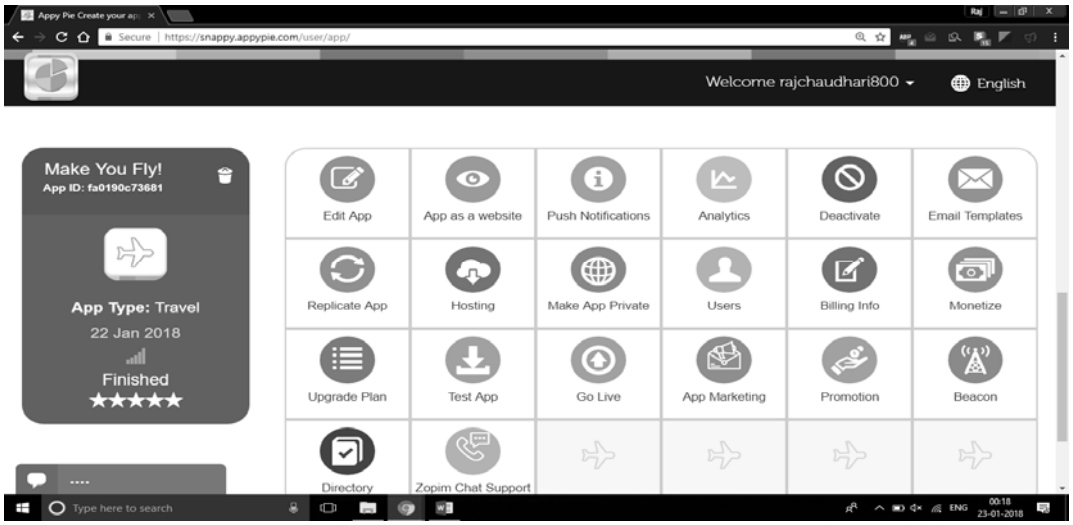
- You will be directed to the following page:



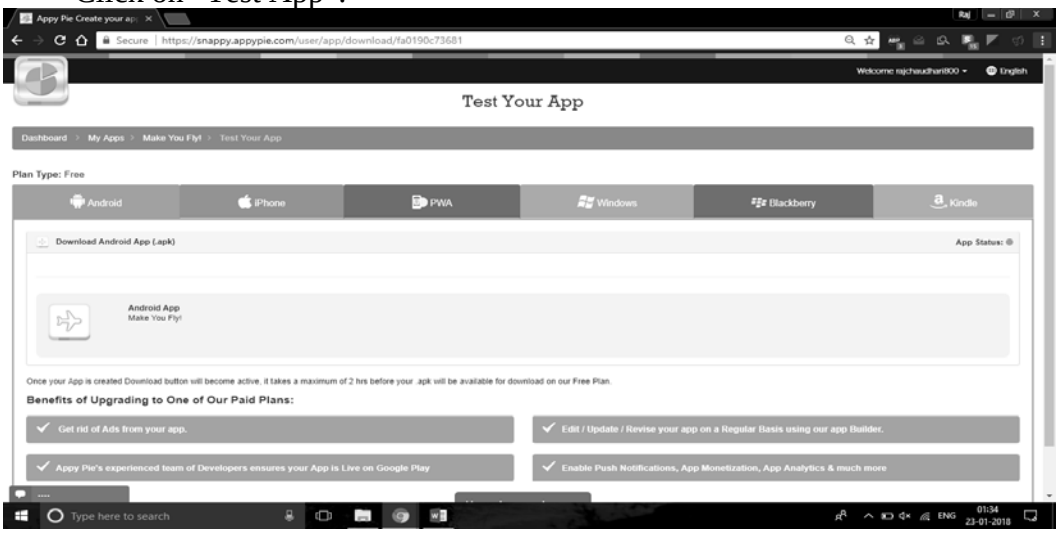
- Click on “FREE” Plan.
- You will be directed to the following page:



- Click on “Continue to My apps”.
- Enter the Verification code sent on your mail id and click verify.
- You will see this page.



- Click on “Test App”.



- Type mail id so that you receive the App link on mail on your mobile phone and download the App on your mobile phone.
- You will receive the App download link.
- This will be a ".apk" file. You are required to download the file in your mobile phone and your App is ready.

XII. Applications

1. Apps can be designed for free
2. Create an App in Minutes
3. No coding skills Required

4. App Revisions/Updates are real time
5. Send push Notifications
6. Apps can be easily Monetized
7. App publishers get real time App Analytics
8. Share App with friends

XIII. Conclusion

- Appy Pie delivers a rich user interface for a mobile application by using HTML5 with JavaScript and CSS. Using Phone GAP API user interfaces can be created with JavaScript component libraries that render interactive user interface widgets using HTML5 elements.

XIV. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. What is smartphone?
2. What are different mobile development solutions?
3. Explain Browser based and native wireless applications.

(Space for answer)

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XV. References / Suggestions for further Reading

1. https://www.appypie,com

XVI. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Use of WWW.appypie.com for developing mobile application.	20%
2	Identifying other wizards for developing mobile application.	30%
3	Follow ethical practices	10%
Product related (10 Marks)		**40%**
4	Observations and recording	20%
5	Answer to sample questions	15%
6	Timely Submission of report	05%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No.11 : Simulate the line coding techniques using MATLAB and Simulink.

I. Practical Significance

Electrical representation of binary codes is called “line code”. A line code is a chosen for use within a communications system for transmitting a digital signal down a transmission line. Line coded signal is used to create an “RF signal” that can be sent through free space. The line-coded signal can be converted to bits on an optical disc. In this practical students will convert the given digital data into various line codes.

II. Relevant Program Outcomes (POs)

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency **“Maintain Wireless and Mobile Network”.**

1. Identify different components, IC’s and blocks on trainer kit and make the connection as per the given experimental set up.
2. Test the output signals at the different testing points and interpret the result as per the observation.

IV. Relevant Course Outcome(s)

Interpret the components of WLL Applications.

V. Practical Outcome(PrOs)

Simulate the line coding techniques using MATLAB and Simulink.

VI. Relevant Affective Domain Related Outcome(s)

1. Maintain tools and equipment.
2. Demonstrate working as a leader / a team member.
3. Follow ethical practices.

VII. Minimum Theoretical Background

Unipolar Non-Return to Zero (NRZ)

In this type of unipolar signaling, a High in data is represented by a positive pulse called as **Mark**, which has a duration $\mathbf{T_0}$ equal to the symbol bit duration. A Low in data input has no pulse. The following figure 1 clearly depicts this.

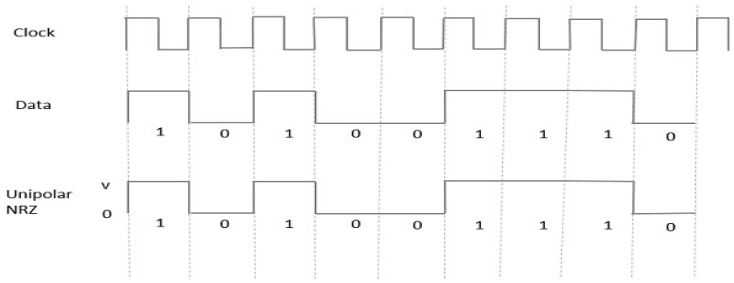


Figure 1 :Unipolar NRZ

Unipolar Return to Zero (RZ)

In this type of unipolar signaling, a High in data, though represented by a **Mark pulse**, its duration $\mathbf{T_0}$ is less than the symbol bit duration. Half of the bit duration remains high but it immediately returns to zero and shows the absence of pulse during the remaining half of the bit duration. It is clearly understood with the help of the following figure 2.

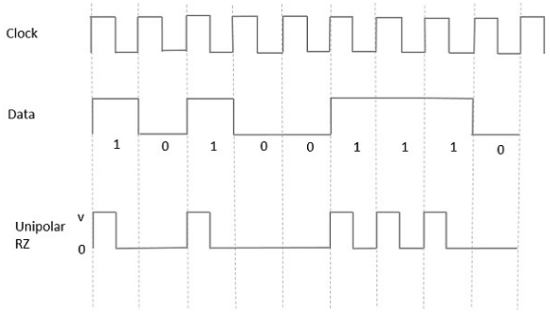


Figure 2: Unipolar RZ

Bipolar Signaling

This is an encoding technique which has three voltage levels namely +, - and 0. Such a signal is called as duo-binary signal. An example of this type is Alternate Mark Inversion (AMI). For a 1, the voltage level gets a transition from + to – or from – to +, having alternate 1s to be of equal polarity. A 0 will have a zero voltage level. Even in this method, we have two types.

- Bipolar NRZ
- Bipolar RZ

From the models so far discussed, we have learnt the difference between NRZ and RZ. It just goes in the same way here too. The following figure 3 clearly depicts this.

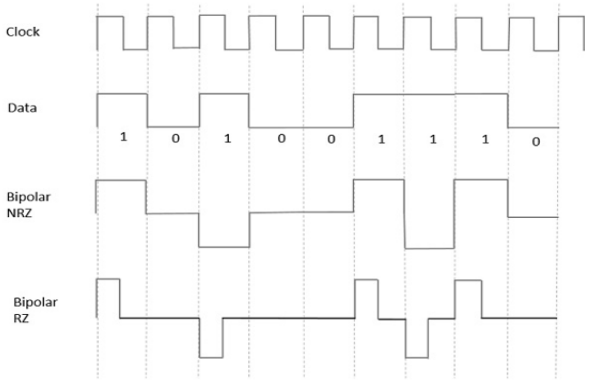


Figure 3: Bipolar NRZ and Bipolar RZ

VIII. Work Situation

a. form a group of two students.
b. Students group will practice simulation of line coding techniques.
c. Faculty will demonstrate the use of MATLAB and simulink to simulate line coding Techniques
   Faculty must

IX. Resources required (Additional)

Sr. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Line Coding kit	8 bit variable NRZ-L pattern Data Simulator using 8 way DIP Switch,15 clock states constant data pattern,125 KHz serial data pattern or equivalent trainer kit.	1	
2.	CRO/DSO	25 MHz, dual scope	1	
3.	Connecting wires	Single Strand Teflon coating (0.6 mm diameter)	As per requirement	
4.	IBM PC Compatible Computer System	Suitable specifications as per requirement of simulation software with Latest Processor	1	
5.	Simulation Software	MATLAB Software		

X. Precautions to be followed

For practical set up

1. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.

For Simulation

1. Ensure proper earthing to the computer system.
2. Ensure compatibility of computer system with software.
3. Ensure proper installation of simulation software.

XI. Procedure

For Practical set up

a. Make the connections as shown in Practical set up diagram.
b. Select the input bit stream form kit to set digital word 01100011.
c. Observe the waveforms of unipolar RZ,NRZ and Bipolar NRZ, Manchester line coding formats using CRO/DSO and draw the waveforms on graph paper.
d. After completion of practical switch off the supply, remove the connection and submit the wires and equipments.

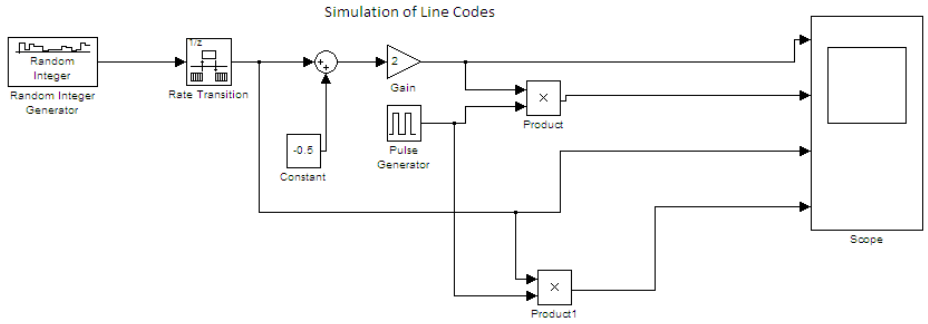
For Simulation

a. Switch on the computer and click on the MATLAB icon.
b. Go to start at the bottom of the command window, then select “simulink” then go to library browser and drag it into creating file.(or) Once you open the MATLAB

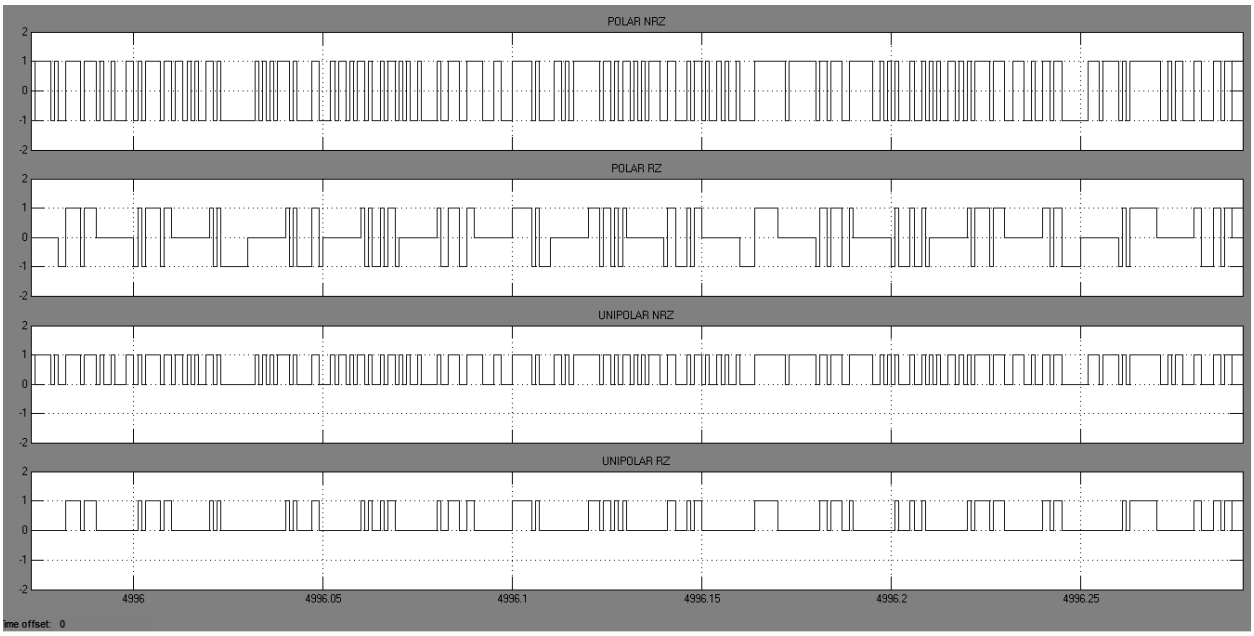
then click on simulink icon .Go to file and select new and then select model. You will get a new window.

c. Arrange the functional blocks as shown in simulink model.
d. Assign required parameters to each functional block
e. Observe the outputs on scope.

XII. Simulink Model of Line coding Techniques



XIII. Simulation Output



XIV. Actual Simulink Block Diagram and Output Observed

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XV. Exercise

(Use blank space for answers or attach more pages if needed)

1. Observe the effect of average DC value and bit duration for unipolar non return zero (UPNRZ) and polar return zero (PRZ)

Sr. No.	Type of line code	DC voltage	Bit duration
1	Polar RZ		
2	Unipolar NRZ		

2. Write MATLAB code for line coding : unipolar, polar, bipolar & Manchester code

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XVI. References / Suggestions for further Reading

1. https://www.sqa.org.uk/elearning/NetTechDC01ECD/page_02.htm
2. https://en.wikipedia.org/wiki/Line_code.
3. https://www.tutorialspoint.com/assembly_programming/

XVII. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the trainer kit	10%
2	Identification of component and Build Block diagram using MATLAB and Simulink	20%
3	Measuring value using suitable instrument and Simulation Output	20%
4	Working in team	10%
Product related (10 Marks)		**40%**
5	Interpretation of result	15%
6	Conclusion	05%
7	Practical related questions and exercise	15%
8	Submitting journal in time	05%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……..

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No.12: Simulate the Binary amplitude shift keying using MATLAB and Simulink.

I. Practical Significance

Amplitude shift keying (ASK) is type of digital modulation that represents digital data as variations in the amplitude of a carrier wave. The amplitude of an analog carrier signal varies in accordance with the bit stream (modulating signal) where frequency and phase are keeping constant. This practical is designed to explain how change of amplitude in to level corresponds to logic 1 and logic 0.ASK is a type of Amplitude Modulation which represents the binary data in the form of variations in the amplitude of a signal. Any modulated signal has a high frequency carrier. The binary signal when ASK modulated ,gives a zero value for low input while it gives the carrier output for high input.

II. Relevant Program Outcomes (POs)

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency **"Maintain Wireless and Mobile Network".**

1. Identify different components, IC's and different blocks on the trainer kit and make the connections as per the given experimental set up.
2. Test the output signals at the different testing points and interpret the output and result as per the observations.

IV. Relevant Course Outcome(s)

Interpret the components of WLL Applications.

V. Practical Outcome(PrOs)

Simulate the Binary amplitude shift keying using MATLAB and Simulink.

VI. Relevant Affective Domain Related Outcome(s)

1. Follow safe practices.
2. Handle tools and instruments carefully.
3. Follow ethical practices.

VII. Minimum Theoretical Background

Any digital modulation scheme uses a finite number of distinct signals to represent digital data. ASK uses a finite number of amplitudes, each assigned unique pattern of binary digital. Each amplitude encodes an equal number of bits. Each pattern of bits forms the symbol that is represented by the particular amplitude. The demodulator is designed especially for the symbol set used by the modulator, determines the amplitude of the received signal and maps it back to the symbol it represents, thus

recovering the original data. Frequency and phase of the carrier are kept constant in ASK.

Amplitude shift keying (ASK) is the digital modulation technique. In Amplitude shift keying, the amplitude of the carrier signal is varied to create signal elements. Both frequency and phase remain constant while the amplitude changes.

In ASK, the amplitude of the carrier assumes one of the two amplitudes dependent on the logic states of the input bit stream. This modulated signal can be expressed as: Amplitude shift keying (ASK) in the context of digital signal communications is a modulation process, which imparts to a sinusoid two or more discrete amplitude levels. These are related to the number of levels adopted by the digital message. For a binary message sequence there are two levels, one of which is typically zero. Thus the modulated waveform consists of bursts of a sinusoid.

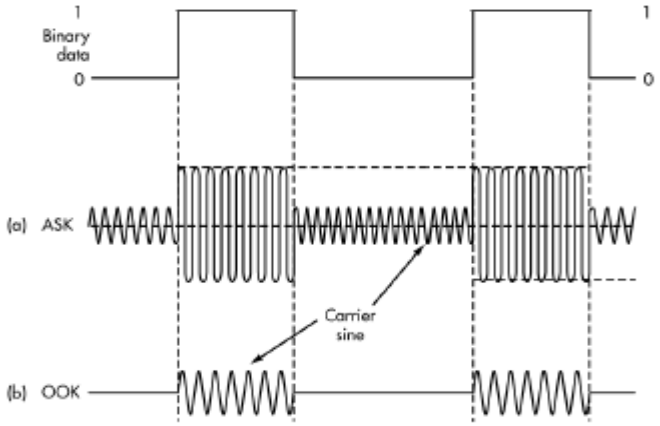


Figure 1: ASK Input Output

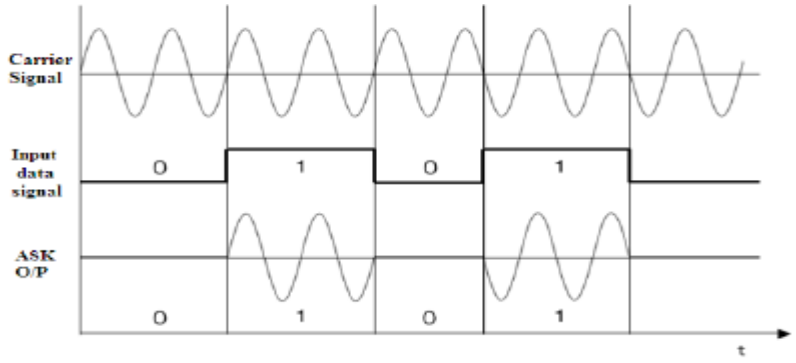


Figure 2: ASK Input Output Waveforms

Practical Circuit Diagram (Sample Block Diagram)

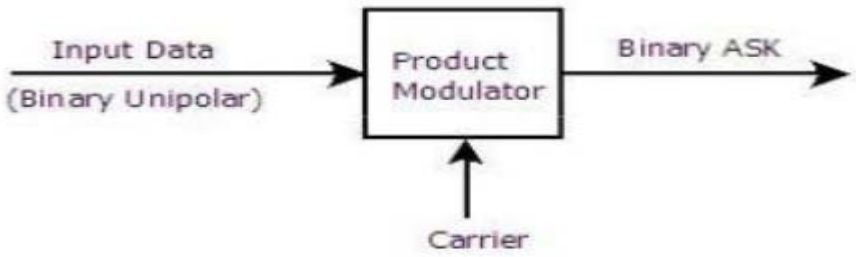


Figure 3: ASK modulator
(Courtesy:https://www.slideshare.net/aknigin/digital-communicationunit-3)

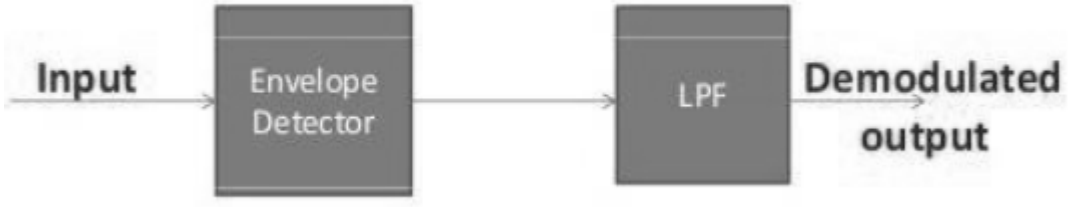


Figure 4: ASK demodulator

(Courtesy:https://www.evalidate.in/lab2/pages/Demod-ASK/DMASK/DMASK_I.htm)

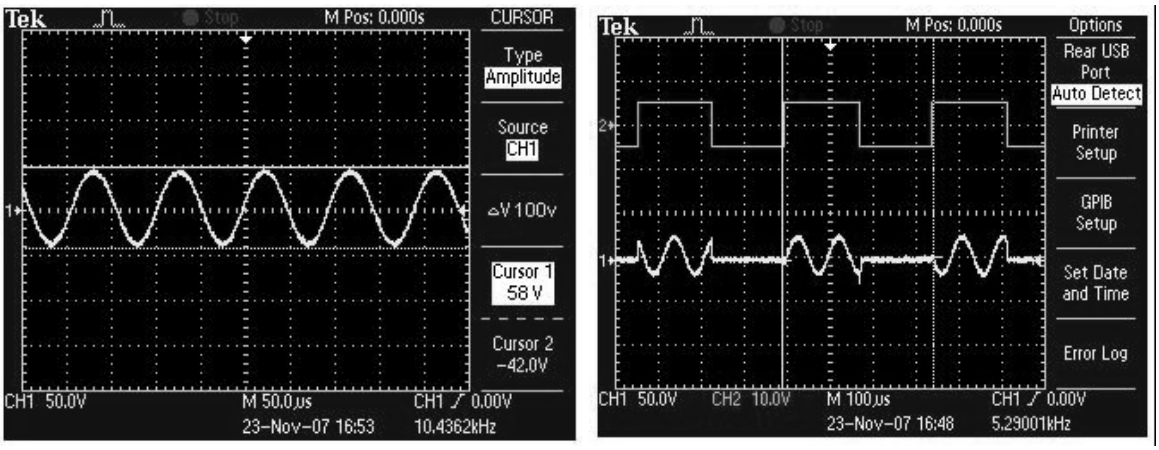


Figure 5: Waveforms of Carrier signal ,Data signal & ASK wave

VIII. Work Situation:

a. Faculty will demonstrate the use of MATLAB and simulink to simulate Amplitude shift keying technique.
b. Faculty must form a group of two students.
c. Students group will practice simulation of ASK.

IX. Resources required (Additional)

Sr. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Dual trace cathode ray oscilloscope/Digital storage oscilloscope	20MHz dual trace oscilloscope/25 MHz Dual trace Digital storage oscilloscope	1	
2.	Power supply	Variable DC Power supply 0-30V,0-2A,SC protection, Digital meters	1	
3.	ASK Trainer kit	Data clock frequency 2KHz,4KHz,8 KHz,16KHz,data 8 bit,16 bit,32 bit,64 bit	1	

		or equivalent trainer kit		
4.	Connecting wires	CRO probes, patch cords	2	
5.	Computer	Latest specifications with high end Processor suitable for Simulation Software	1	
6.	Simulation Software	MATLAB Software	1	

X. Precautions to be followed

For practical set up

1. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.

For Simulation

1. Ensure proper earthing to the computer system.
2. Ensure compatibility of computer system with software.
3. Ensure proper installation of simulation software.

XI. Procedure

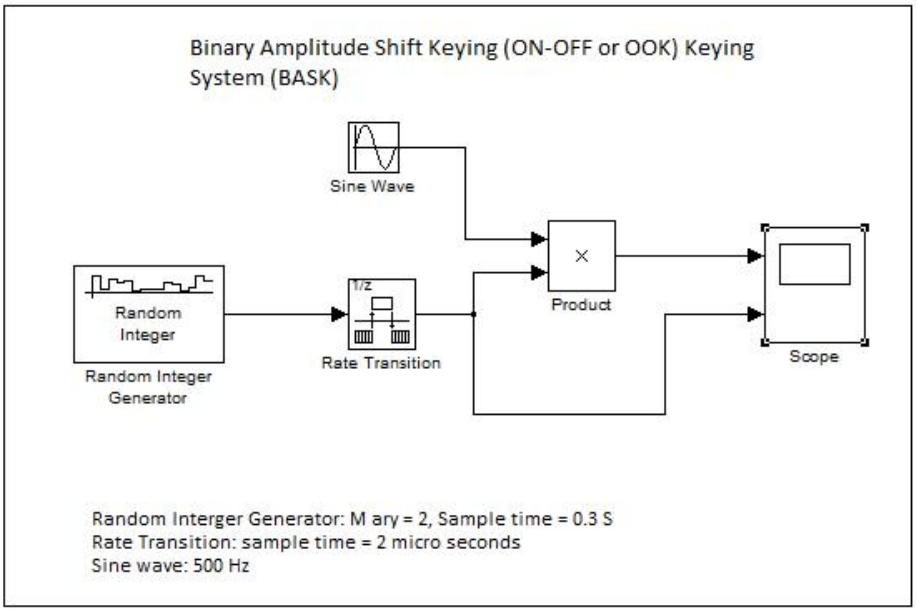
For Practical set up Circuit Diagram

a. Make the connection as per circuit diagram.
b. Switch ON the power supply.
c. Connect digital input signal 1010110 on to the trainer kit of ASK modulator.
d. Observe the output of ASK modulator on CRO.
e. Connect output of ASK modulator to input of ASK demodulator.
f. Observe the output of ASK demodulator.
g. Draw the waveform on graph showing digital input signal, carrier signal, modulated signal and demodulated signal.
h. After completion of practical switch off the supply, remove the connection and submit the wires and equipments.

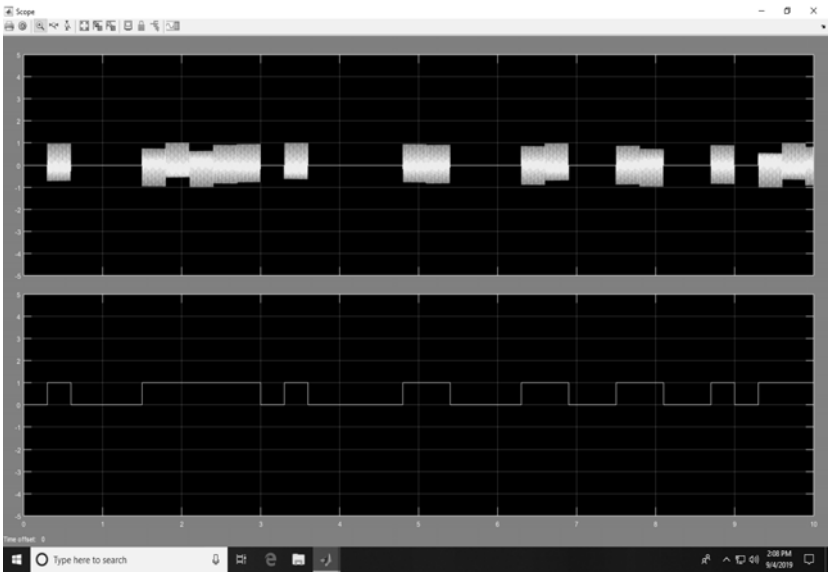
For Simulation

a. Switch on the computer and click on the MATLAB icon.
b. Go to start at the bottom of the command window, then select “simulink” then go to library browser and drag it into creating file.(or) Once you open the MATLAB then click on simulink icon  .Go to file and select new and then select model. You will get a new window.
c. Arrange the functional blocks as shown in simulink model.
d. Assign required parameters to each functional block.
e. Observe the outputs on scope.

XII. Simulink Model of Amplitude Shift Keying Technique



XIII. Simulation Output



XIV. Actual Simulink Block Diagram and Output Observed

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XV. Conclusion

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XVI. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. Observe the ASK output for bit stream 1100101
2. Observe the ASK output for bit stream 1110100

Note: Use graph paper to draw waveforms of ASK.

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XVII. Exercise

(Use blank space for answers or attach more pages if needed)

1. Observe Waveforms at various stages of ASK

Sr. No.	Output at	Amplitude	Time Period	Frequency	Waveform
1	Input signal bit stream				
2	Carrier signal				
3	ASK Modulator output				
4	ASK Demodulator output				

2. Write MATLAB Code for generation of ASK waveform and execute same.

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XVIII. References / Suggestions for further Reading

1. http://www.allsyllabus.com/aj/note/ECE/Digital%20Communication/unit3/index.php#.W0MQ69UzbIU.
2. http://www.evalidate.in/lab2/pages/ASK-M/ASK/ASK-T.html
3. http://www.srmuniv.ac.in/sites/default/files/files/TN0501%lab20mannual.pdf
4. https://www.google.co.in/search?q=ask+waveform&source

XIX. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Identification of different blocks on trainer kit and handling of simulation software	10%
2	Preparation of Experimental set up and building of diagram	20%
3	Observation and measurement of various output on trainer kit and measuring values from PC Screen	20%
4	Handling of the kit and working in team	10%
Product related (10 Marks)		**40%**
5	Correctness of output	15%
6	Interpretation of result and conclusion	05%
7	Practical related questions and exercise	15%
8	Submitting the journal in time	05%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 13: Simulate the Binary Phase shift keying using MATLAB and Simulink.

I. Practical Significance

PSK technique is widely used for wireless LANs, biometric, contactless operations, along with RFID and Bluetooth communications. BPSK has a bandwidth which is lower than that of BFSK signal. It has a very good noise immunity. This practical enable the students to generate and decode BPSK signal.

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II. Relevant Program Outcomes (POs)

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency **"Maintain Wireless and Mobile Network".**

1. Identify different components, IC's and blocks on trainer kit and make the connections as per given experimental set up.
2. Test the output signals at the different testing points and simulate using MATLAB and Simulink and interpret the result as per the observation.

IV. Relevant Course Outcome(s)

Interpret the components of WLL Applications.

V. Practical Outcome(PrOs)

Simulate Binary Phase Shift Keying (BPSK) using MATLAB and Simulink.

VI. Relevant Affective Domain Related Outcome(s)

1. Follow safe practices.
2. Handle tools and instruments carefully.
3. Follow ethical practices.

VII. Minimum Theoretical Background

Phase Shift Keying (PSK) is the digital modulation technique in which the phase of the carrier signal is changed by varying the sine and cosine inputs at a particular time with respect to the given digital input. Figure 1 shows BPSK modulator.

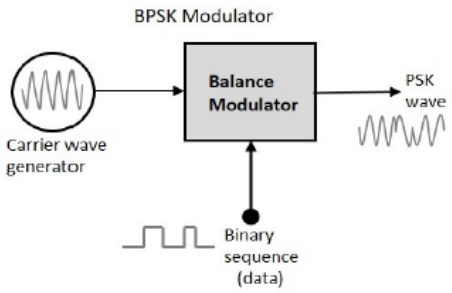


Figure 1: Generation of PSK/BPSK Modulator

In BPSK modulation, phase of the carrier signal is changed according to the data bit to be transmitted. Keeping its frequency and amplitude constant as shown in Figure 2.

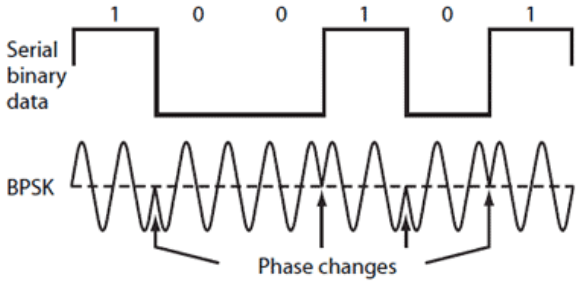


Figure 2: Waveform of BPSK Modulation

BPSK demodulator:

Figure 3 shows BPSK demodulator. The BPSK modulating signal is demodulated with a synchronous detection system. The synchronous detection system uses a modulator to multiply the received signal and regenerated carrier wave. The frequency and phase of the regenerated carrier wave must match (synchronize with) the carrier wave used on the transmitted end.

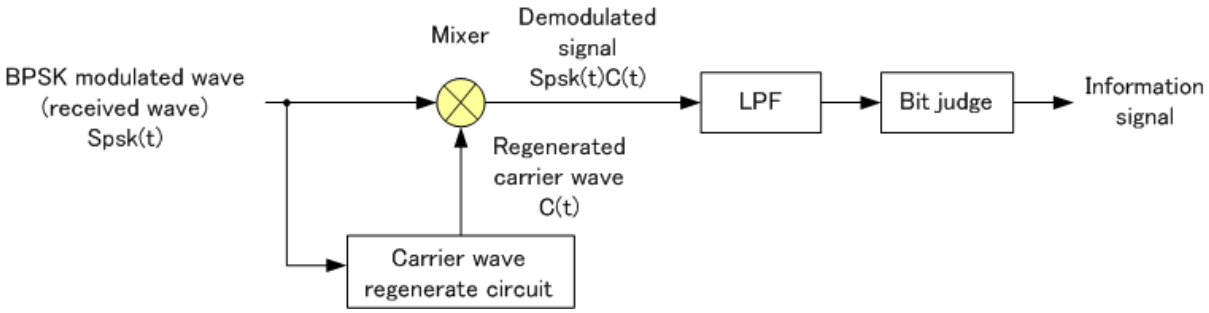


Figure 3: BPSK demodulator

Practical Circuit Diagram:

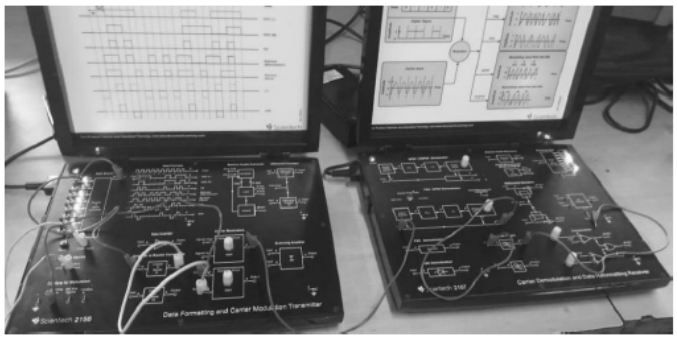
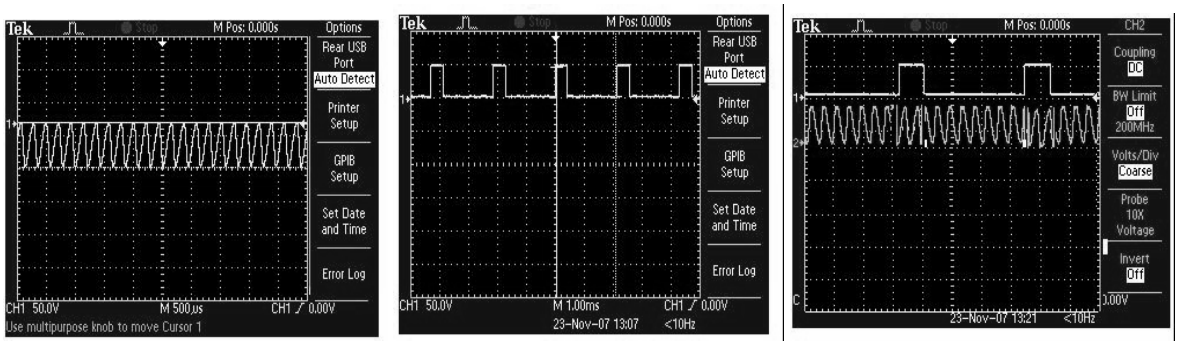


Figure 4: Practical set up for BPSK modulation and demodulation



(a) **(b)** **(c)**

Figure 5: Waveforms of (a) Carrier signal (b) Modulating signal (c) PSK output

VIII. Work Situation:

a. Faculty will demonstrate the use of MATLAB and simulink to simulate BPSK Technique.
b. Faculty must form a group of two students.
c. Students group will practice simulation of BPSK Technique.

IX. Resources required (Additional)

Sr. No.	Instrument /Components	Specification	Quantity	Remarks
1.	BPSK modulator and demodulator trainer kit	Four type selectable data clock frequency2KHz,4KHz,8KHz,16KHz,And four selectable types bit data 8 bit,16 bit,32 bit,64 bit or equivalent trainer kit	1	
2.	CRO/DSO	25MHz,dual Trace/Bandwidth 30MHz-200MHz	1	
3.	Connecting wires	Single strand Teflon coating(0.6 mm diameter)	As per requirement	
4.	IBM PC Compatible Computer System	Suitable specifications as per requirement of simulation software with Latest Processor	1	
5.	Simulation Software	MATLAB Software		

X. Precautions to be followed

For practical set up

a. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.

b. While doing the experiment adjust proper volt/div and times/div selection on CRO/DSO.

For Simulation

a. Ensure proper earthing to the computer system.

b. Ensure compatibility of computer system with software.

c. Ensure proper installation of simulation software.

XI. Procedure

For practical set up Circuit Diagram

a. Make connections as shown in figure.

b. Select input data 11001011 from data generator using switches and connect it to bipolar convertor.

c. Connect bipolar data to signal input of balanced modulator (BPSK modulator)

d. Select carrier signal from carrier generator and connect it to carrier input of balanced modulator (BPSK modulator).

e. Switch on the power supply.

f. Connect DSO/CRO probe at output of balanced modulator (BPSK modulator).

g. Observe output waveforms of balanced modulator (BPSK modulator) on CRO.

h. Write output signal phase shift with respect to carrier for input signal (logic 1 and logic 0) in observation table.

Sr. No.	Input Signal	Modulated output signal phase shift w.r.t carrier

i. For BPSK demodulation connect output of balanced modulator (BPSK modulator) to input of BPSK demodulator kit as shown in figure.

j. Observe the output of low pass filter on CRO/DSO.

k. Draw the waveform of input data, carrier signal, BPSK signal and output of low pass filter on graph paper for observed value.

l. After completion of practical switch off the supply, remove the connection and submit the wires and equipments.

For Simulation

a. Switch on the computer and click on the MATLAB icon.

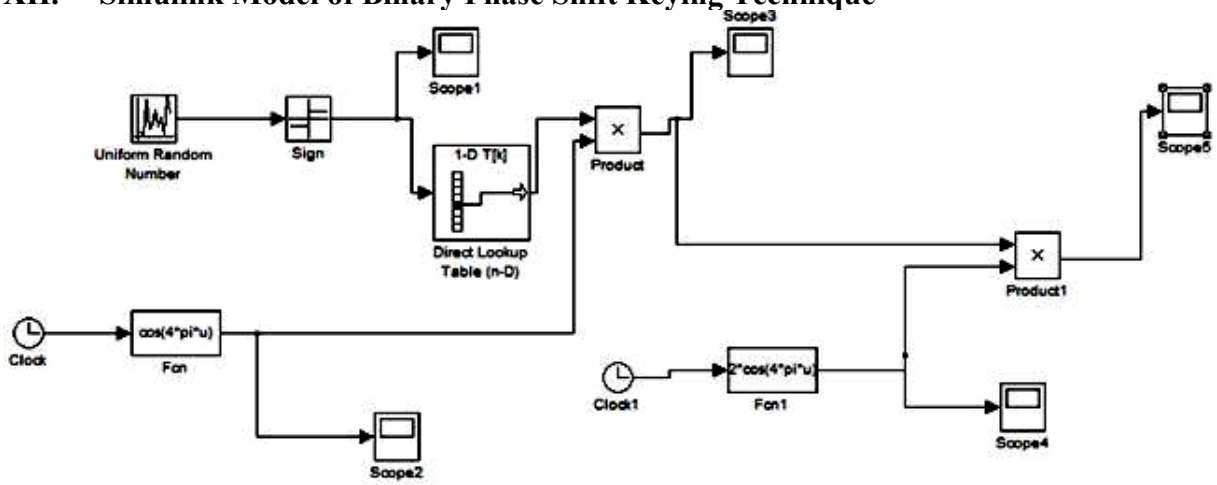
b. Go to start at the bottom of the command window, then select “simulink” then go to library browser and drag it into creating file.(or) Once you open the MATLAB then click on simulink icon  .Go to file and select new and then select model. You will get a new window.

c. Arrange the functional blocks as shown in simulink model.

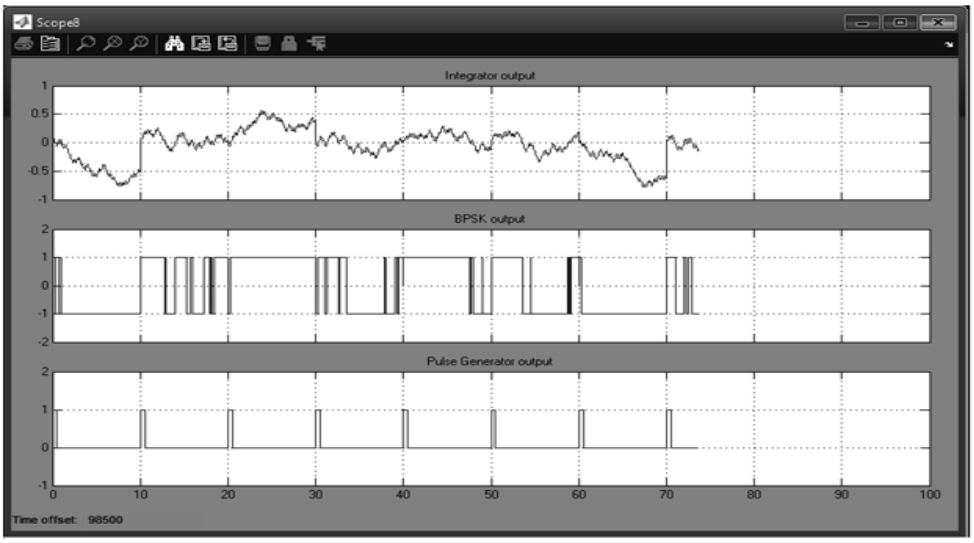
d. Assign required parameters to each functional block.

e. Observe the outputs on scope.

XII. Simulink Model of Binary Phase Shift Keying Technique



XIII. Simulation Output



XIV. Actual Simulink Block Diagram and Output Observed

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XV. Conclusion

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XVI. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. Draw BPSK modulated waveforms for input data 11110000
2. Draw BPSK modulated waveforms for input data 10101010
3. Draw BPSK modulated waveforms for input data 11111111
4. Draw BPSK modulated waveforms for input data 11001100

Note: Use graph paper to draw waveforms of BPSK.

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XVII. Exercise

(Use blank space provide for answers or attached more pages if needed)

1. Write Algorithm and MATLAB Code and draw flowchart for BPSK Modulation and demodulation technique.
2. What are real life applications of BPSK Technique and advantages
3. Why BPSK technique is called switching & signaling? Define PSK.
4. Plot Spectrum of PSK and what is bandwidth of PSK?
5. Draw the signal space representation of PSK and what is significance of Euclidean distance?

(Space for answers)

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XVIII. References / Suggestions for further Reading

1. https://www.ques10.com/p/3631/explain-the-operating-principle-working-of-trans-1/
2. http://www.gaussianwaves.com/2010/04/bpsk-modulation-and-demodulation-2/

XIX. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Identification of different blocks on trainer kit and handling of Simulation Software	10%
2	Preparation of Experimental set up and building of diagram	20%
3	Observation and measurement of various output on trainer kit and measuring values from PC Screen	20%
4	Handling of the kit and working in team	10%
Product related (10 Marks)		**40%**
5	Correctness of output	15%
6	Interpretation of result and conclusion	05%
7	Practical related questions and exercise	15%
8	Submitting the journal in time	05%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……

Process Related(15)	Product Related(10)	Total (25)	

Practical No. 14: Simulate the Delta Modulation using MATLAB and Simulink

I. Practical Significance

In PCM the signaling rate and transmission channel bandwidth are quite large since it transmits all the bits which are used to code a sample. To overcome this problem, Delta modulation is used. A delta modulation is an analog to digital and digital to analog signal conversion technique used for transmission of voice information.DM is the simplest form of differential pulse code modulation (DPCM) where the difference between successive samples is encoded in to n-bit data streams .In delta modulation, the transmitted data are reduced to a 1-bit data stream. This practical is designed to explain how different types of information signals which are analog in nature can be converted to digital form.

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II. Relevant Program Outcomes (POs)

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified Competency **"Maintain Wireless and Mobile Network".**

1. Identify different components, IC's and blocks on the trainer kit and make the connection as per the given experimental set up.
2. Test the output signals at the different testing points and interpret the result as per the observations and simulate using MATLAB and Simulink.

IV. Relevant Course Outcome(s)

Interpret the components of WLL Applications.

V. Practical Outcome(PrOs)

Simulate the Delta Modulation using MATLAB and Simulink.

VI. Relevant Affective Domain Related Outcome(s)

1. Follow safe practices.
2. Handle tools and equipments carefully.
3. Follow ethical practices.

VII. Minimum Theoretical Background

Delta modulation is a Differential Pulse Code Modulation (DPCM) technique in which the difference signal is encoded into a single bit. Delta modulation provides a staircase approximation of the input sampled signal where only one bit per sample is transmitted. This one bit is sent by comparing the present sample value with the previous sample value and the result whether the amplitude is to be increased or decreased is transmitted. If the step is reduced,0 is transmitted and if the step is

increased then 1 is transmitted. The figure illustrates the block diagram of Delta Modulation Transmitter.

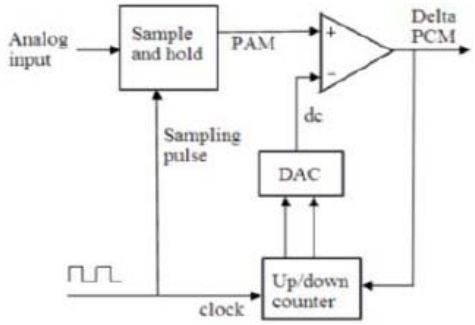


Figure 1: Delta Modulation Transmitter

Sample and hold circuit will sample the analog input signal in to Pulse amplitude modulated (PAM) signal. The Up-down counter stores the magnitude of the previous sample in the binary value. This binary number is converted in to equivalent voltage in the Digital to analog converter (DAC).The PAM signal and the DAC output are compared in the comparator. The Up-down counter is incremented or decremented depending on whether the previous sample is larger or smaller than the current sample. The output of the comparator generates the Delta pulse code modulated signal. The figure illustrates the block diagram of Delta Modulation Receiver.

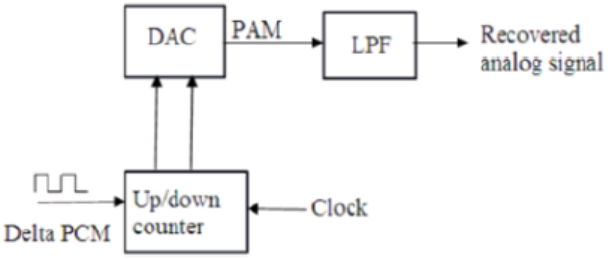


Figure 2: Delta Modulation Receiver

The receiver of the delta modulator consists of DAC, up/down counter and LPF. The Delta PCM signal is fed to the up/down counter. Based on the input received from the up/down counter, DAC will generate the output PAM signal. The output of DAC is given LPF which will filter out high frequency component. Thus the output signal of DAC in the transmitter and receiver is identical to the original information signal. There are two distortions; slope overload error and granular noise are present in DM

Practical Circuit Diagram:

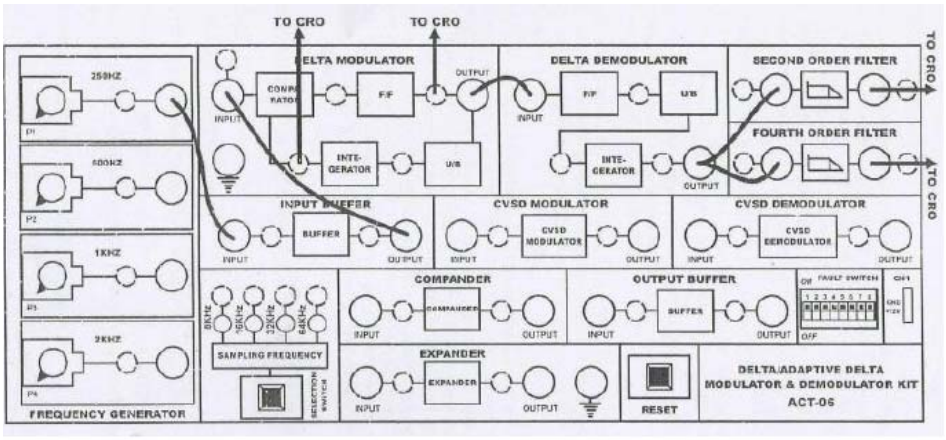
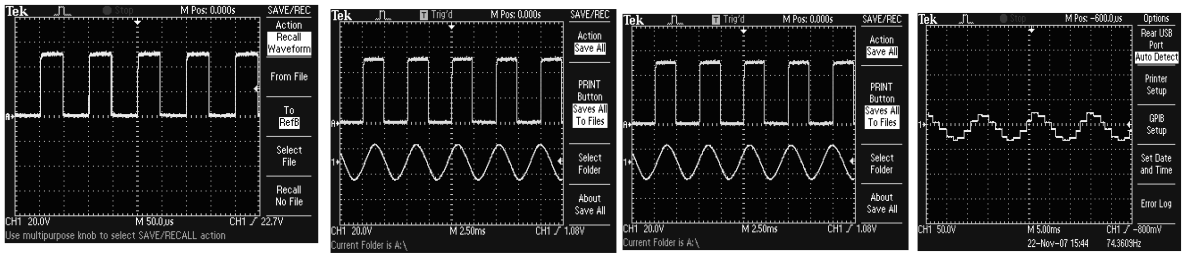


Figure 3: Practical set up



(a) (b) (c)

Waveforms (a) Clock input (b) Delta modulation output & message signal (c) D/A converter output

VIII. Work Situation:

a. Faculty will demonstrate the use of MATLAB and simulink to simulate Delta Modulation Technique.
b. Faculty must form a group of two students.
c. Students group will practice simulation of Delta Modulation

IX. Resources required (Additional)

Sr. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Dual trace cathode ray oscilloscope. Digital storage oscilloscope	30MHz dual trace oscilloscope/25MHz Dual Trace Digital Storage Oscilloscope	1	
2.	Power supply	(0-30V,0-2A)	1	
3.	DM Trainer kit	Input frequency(250Hz,500Hz,1KHz,2KHz), Sampling frequency (8,16.32.64)KHz or equivalent trainer kit.	1	
4.	Connecting wires	CRO probes, patch cords	2	
5.	IBM PC Compatible Computer System	Suitable specifications as per requirement of simulation software with Latest Processor	1	
6.	Simulation Software	MATLAB Software		

X. Precautions to be followed

For Practical set up

a. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.

For Simulation

a. Ensure proper earthing to the computer system.
b. Ensure compatibility of computer system with software.
c. Ensure proper installation of simulation software.

XI. Procedure

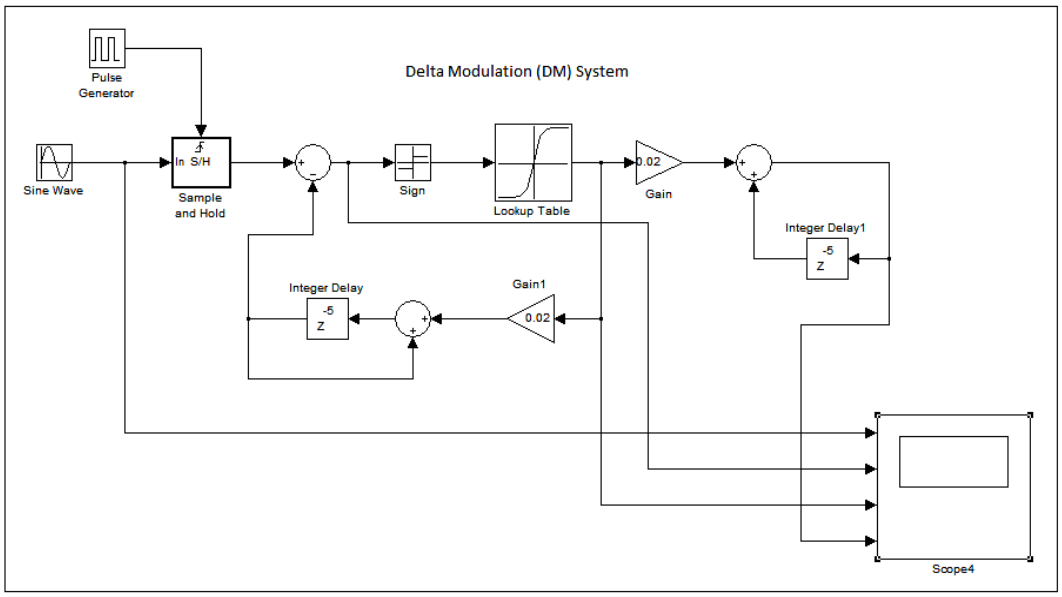
For Practical set up Circuit Diagram

a. Make the connection as shown in figure.
b. Switch ON the power supply.
c. Set the input information signal at 1Vpp,500Hz.
d. Connect the above set input to DM modulator input i.e to comparator input.
e. Select the sampling frequency of 8 KHz.
f. Observe the integrator output by varying amplitude from 0.5V to 1V.
g. Observe the output wave format various block output of DM modulator.
h. Connect the output of DM modulator to demodulator the input.
i. Observe the output of DM demodulator.
j. Observe the waveform at the output of filter by connecting the output of demodulator to the input of low pass filter.
k. Repeat the above procedure from step f to j for sampling frequency of 32 KHz.
l. Draw observed waveforms on the graph paper.
m. After completion of practical switch off the supply, remove the connection and submit the wires and equipments.

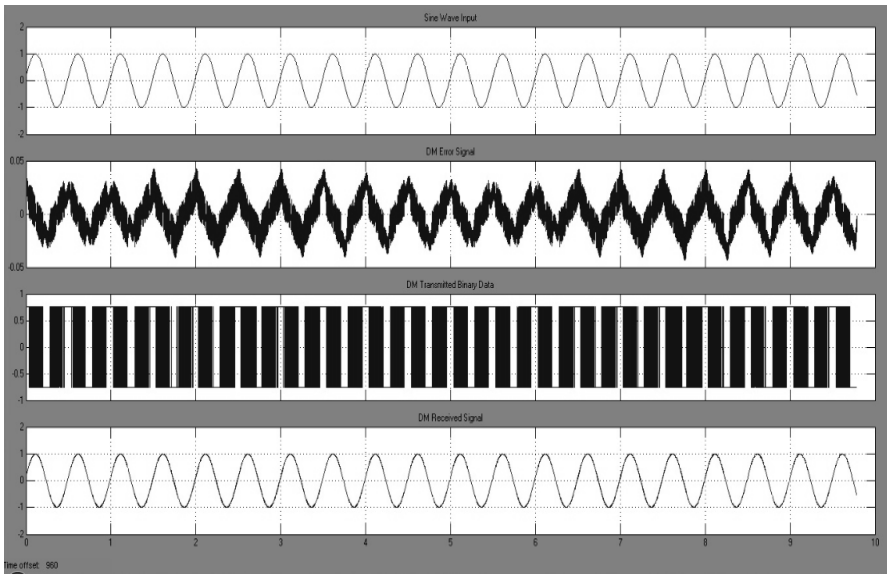
For Simulation

a. Switch on the computer and click on the MATLAB icon.
b. Go to start at the bottom of the command window, then select “simulink” then go to library browser and drag it into creating file.(or) Once you open the MATLAB then click on simulink icon  .Go to file and select new and then select model. You will get a new window.
c. Arrange the functional blocks as shown in simulink model.
d. Assign required parameters to each functional block.
e. Observe the outputs on scope.

XII. Simulink Model of Delta Modulation Technique



XIII. Simulation Output



XIV. Actual Simulink Block Diagram and Output Observed

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XV. Conclusion

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XVI. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. Observe the effect of increasing or decreasing amplitude of input signal on DM output.

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2. Observe the effect of on increase or decrease in amplitude of input signal on integrator output.

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XVII. Exercise

(Use blank space provide for answers or attached more pages if needed)

1. Observe waveforms at various stages of DM and complete following Observation table and draw waveforms on graph paper.

Sr. No.	Output at	Amplitude	Time Period	Frequency
1	Input Signal			
2	Sampling Signal			
3	Integrator signal			
4	DM Modulator output			
5	Compressor output			
6	Expander output			
7	DM demodulator output without filter			
8	DM demodulator output with filter			

2. Write a MATLAB Program to perform Delta Modulation

(Space for answers)

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XVIII. References / Suggestions for further Reading

1. https://www.eng.auburn.edu/-troppel/courses/TIMS-manuals-r5/TIMS%20Experiment%20Manuals/Student_Text/Vol-D1/D1-13.pdf
2. http://www.slideshare.net/stk_gpg/pulse-modulation-9526921?next_slideshow=1
3. https://www.slideshare.net/azizulhoque539/311-pulse-modulation

XIX. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the trainer kit	10%
2	Identification of component and Build Block diagram using MATLAB and Simulink	20%
3	Measuring value using suitable instrument and Simulation Output	20%
4	Working in team	10%
Product related (10 Marks)		**40%**
5	Interpretation of result	15%
6	Conclusion	05%
7	Practical related questions and exercise	15%
8	Submitting journal in time	05%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 15: Simulate the Direct Sequence Spread Spectrum using MATLAB and Simulink.

I. Practical Significance

CDMA technology is known as a spread spectrum technique which allows many users to occupy the same time and frequency allocations in a given band and space. Individual conversations are encoded with the help of pseudo-random digital sequence. This practical is designed to explain how two different signals can be send using CDMA-DSSS and reconstructed successfully at other end.

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II. Relevant Program Outcomes (POs)

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems.

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency **"Maintain Wireless and Mobile Networks".**

1. Identify different components, IC's and different blocks on the trainer kit and make the connections as per the given experimental set up.
2. Test the output signals at the different testing points and interpret the result as per the observations and simulate it.

IV. Relevant Course Outcome(s)

Interpret the components of WLL Applications.

V. Practical Outcome(PrOs)

Simulate the Direct Sequence Spread spectrum using MATLAB and Simulink.

VI. Relevant Affective Domain Related Outcome(s)

1. Follow safe practices.
2. Handle tools and instruments carefully.
3. Follow ethical practices.

VII. Minimum Theoretical Background

CDMA technology is known as a spread-spectrum technique which allows many users to occupy the same time and frequency allocations in a given band and space. Types of spread spectrum Communications: There are two types of spread spectrum communications:

1. Frequency Hopping
2. Direct Sequence

CDMA employs analog to digital conversion (ADC) in combination with spread spectrum technology. Audio input is first digitized into binary elements. The frequency of the transmitted signal is then made to vary according to a defined pattern

(code),so it can be intercepted only by a receiver whose frequency response is programmed with the same code, so it follows exactly along with the transmitter frequency.

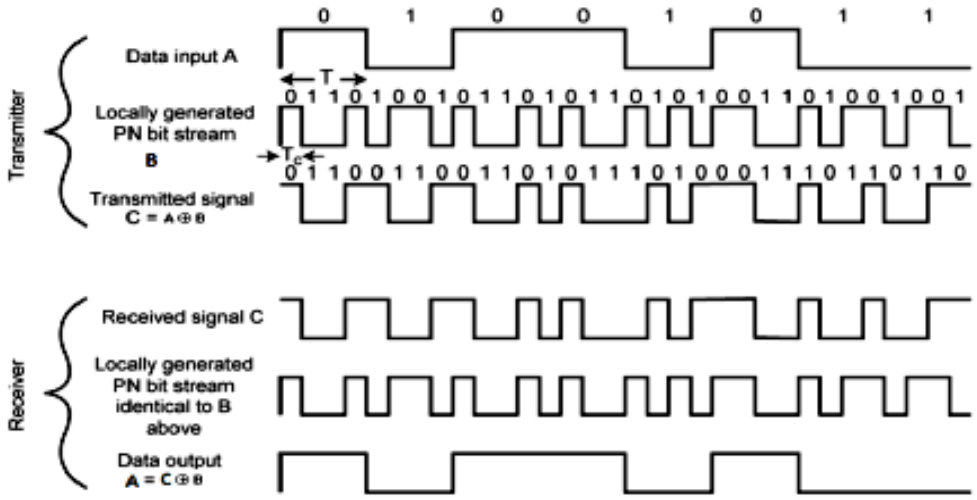


Figure 1: CDMA-DSSS waveforms

(Courtesy:https://www2rivier.edu/faculty/vriabov/CS553_ST7_Ch09-spreadspectrum.ppt)

Practical Circuit Diagram:

Sample Block Diagram:

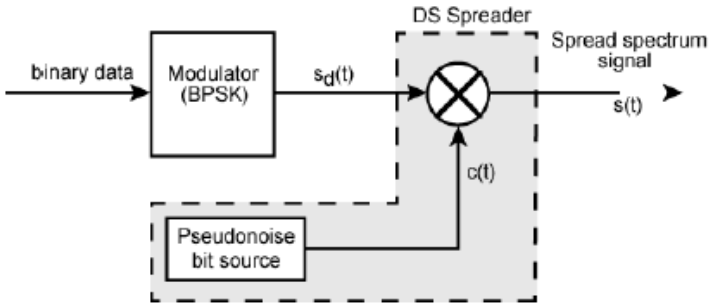


Figure 2: CDMA-DSSS Transmitter

(Courtesy:https//www2.rivier.edu/faculty/vriabov/CS553_ST7_Ch09-spreadspectrum.ppt)

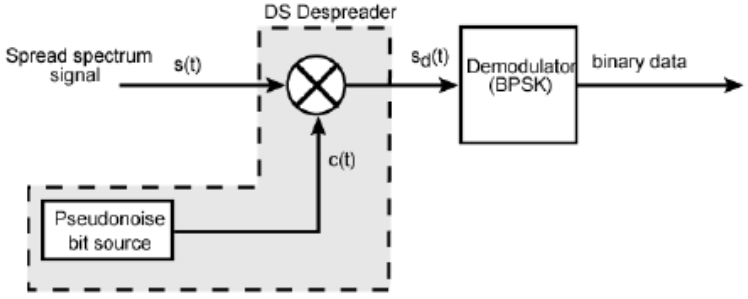


Figure 3: CDMA-DSSS Receiver

(Courtesy:https//www2.rivier.edu/faculty/vriabov/CS553_ST7_Ch09-spreadspectrum.ppt)

Sample Practical Setup:

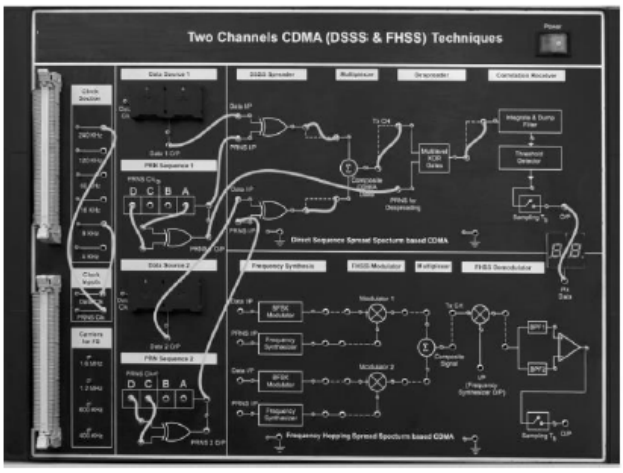


Figure 4: CDMA-DSSS Practical set up

VIII. Work Situation:

a. Faculty will demonstrate the use of MATLAB and Simulink to simulate DSSS technique.
b. Faculty must form a group of two students.
c. Students group will practice simulation of DSSS Technique.

IX. Resources required (Additional)

Sr. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Dual trace cathode ray oscilloscope/Digital Storage oscilloscope	20MHz dual trace oscilloscope/25 MHz Dual Trace Digital storage Oscilloscope	1	
2.	Power Supply	Variable DC Power supply 0-30V,0-2 A,SC protection Digital meters	1	
3.	CDMA-DSSS Trainer kit	Two channel, Four bit PN sequence or equivalent trainer kit	1	
4.	Connecting wires	CRO Probes, patch cords	2	
5.	IBM PC Compatible Computer System	Suitable specifications as per requirement of simulation software with Latest Processor	1	
6.	Simulation Software	MATLAB Software		

X. Precautions to be followed

For practical Setup

a. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.

For Simulation

a. 1.Ensure proper earthing to the computer system.
b. 2.Ensure compatibility of computer system with software.
c. 3.Ensure proper installation of simulation software.

XI. Procedure

For Practical set up Circuit Diagram

a. Make the connection as per figure.
b. Switch ON the power supply.

For CDMA DSSS Transmitter:

a. Connect 8KHz clock signal from the clock section to “data clk” of the clock input section.
b. Connect 240 KHz clock signal from the clock section to “PRNS clk” of the clock input section.
c. Connect input of the feedback EX-OR gate of PRNS sequence-1 and PRNS sequence-2.
d. Connect Data-1 output of “data generator-1” to “data input” of one of the two EX-OR gate under DSSS modulator section.
e. Connect “PRNS input” of same EX-OR gate to the “PRNS-1 output of the PRNS sequence-1 generator.
f. Connect Data-2 output of “data generator-2” to “data input” of other EX-OR gate under DSSS modulator section.
g. Connect “PRNS input” of same EX-OR gate to the “PRNS-2 output of the PRNS sequence-2 generator.
h. Connect the output of these EX-OR gates to the respective inputs of the MUX.
i. Observe the data output of data generators and PRNS sequence output of PRNS sequence generator.
j. Observe the DSSS spread signal at the output of DSSS modulator.
k. Observe the final multiplexed CDMA signal at the output of the MUX.

For CDMA DSSS Receiver:

a. Connect the output of MUX to the demodulator input.
b. Connect the PRNS sequence-1 at the PRNS for dispreading socket of demodulator.
c. Connect the output of demodulator to the input of correlation receiver.
d. Draw observed waveform in following table.
e. Note: The above procedure is given for experimental setup as shown in fig.
f. Procedure will change for different setups so do refer the practical manual.

Sr. No.	Output at	Waveform
1	Carrier clock signal	
2	Bit clock signal	
3	Data-1 (Modulator section)	
4	PRNS-1	
5	MUX output/DSSS Signal	
6	PRNS dispreading output	

Procedure For Simulation

a. Switch on the computer and click on the MATLAB icon.

b. Go to start at the bottom of the command window, then select “simulink” then go to library browser and drag it into creating file.(or) Once you open the MATLAB then click on simulink icon .Go to file and select new and then select model. You will get a new window.

c. Arrange the functional blocks as shown in simulink model.

d. Assign required parameters to each functional block.

e. Observe the outputs on scope.

XII. Simulink Model of DSSS Technique

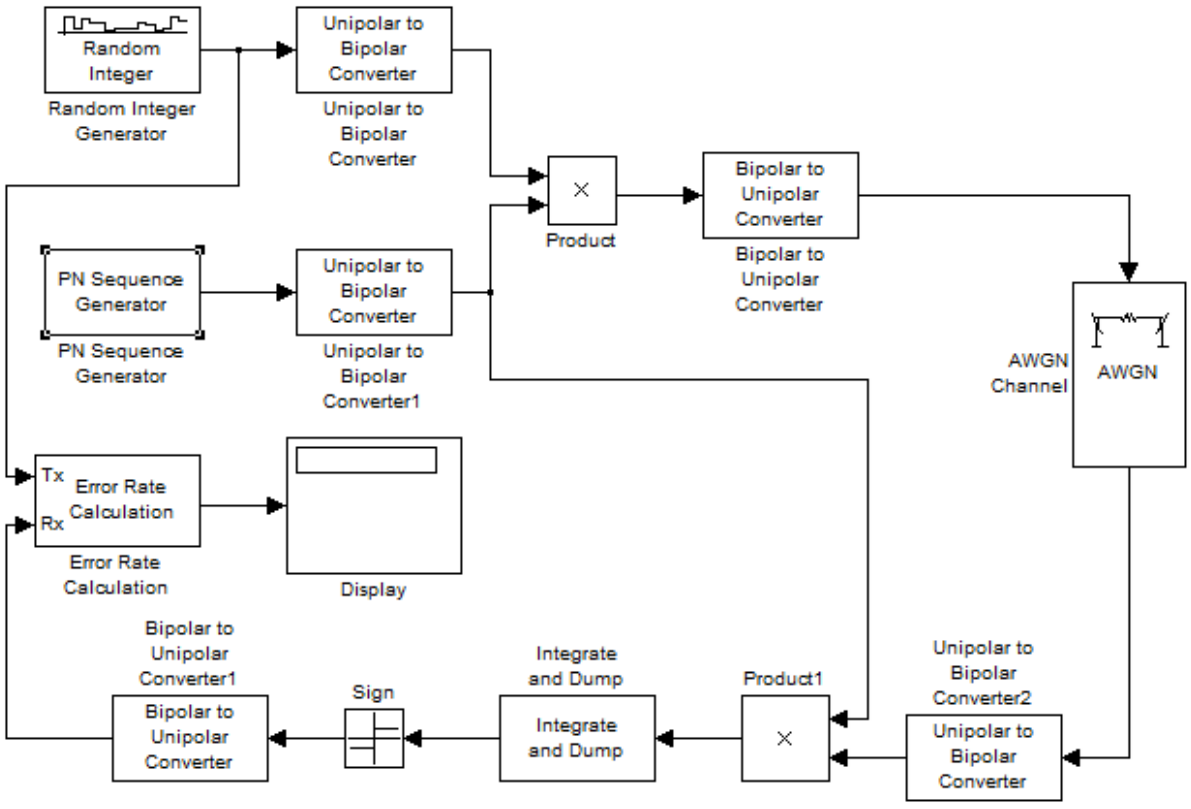
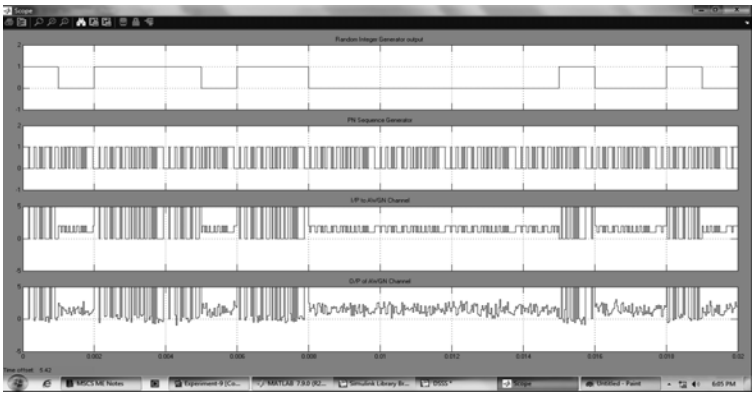


Figure 5: Model of DSSS Technique

XIII. Simulation Output



XIV. Actual Simulink Block Diagram and Output Observed

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XV. Conclusion

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XVI. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. Use PN-sequence for the Direct Sequence Spread Spectrum (DSSS) signal to trace the DSSS signal corresponding to 2 different bit patterns and the same PN-sequence used as the modulator.
2. Observe the DSSS signal corresponding to 2 different bit patterns for clock frequency 120KHz.

Note: Use graph paper to draw waveforms of DSSS.

(Space for answer)

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XVII. Exercise

(Use blank space provide for answers or attached more pages if needed)

1. Generate PN sequence using MATLAB code.

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XVIII. References / Suggestions for further Reading

1. https://www.elprocus.com/cdma-technology-working-applications/
2. http://www2.rivier.edu/faculty/vriabov/CS553_ST7_Ch09-Spreadspectrum.ppt
3. https://www.ccsneu.edu/home/rraj/courses/G250/S05/Lectures/SpreadSpectrum.ppt

XIX. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Identification of different blocks on trainer kit	10%
2	Preparation of Experimental Setup and Build Block diagram using MATLAB and Simulink	20%
3	Observation and measurement of various output on Trainer kit	20%
4	Handling of the kit and working in team	10%
Product related (10 Marks)		**40%**
5	Interpretation of result	15%
6	Conclusion	05%
7	Practical related questions and exercise	15%
8	Submitting journal in time	05%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 16: Simulate WSN node to determine position on node and blink LED using cup carbon simulator and senscript.

I. Practical Significance

Wireless sensor networks (WSNs) are a technology in continuous evolution with great future and a huge quantity of applications. The implementation and deployment of a WSN imply important expenses, so it is interesting to simulate the operation of our design before deploying it. In addition, WSNs are limited by a set of parameters such as the low processing capacity, low storing capacity or limited energy. Energy consumption is the most limiting parameter since the network stability and availability depends on the survival of the nodes. To check the correct operation of a network, currently, there are several network simulators and day by day new proposals are launched.

II. Relevant Program Outcomes (POs)

PO 1. Basic knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the problems related to application of computers and communication services in storing, manipulating and transmitting data, often in the context of business or other enterprise.

PO 2- Discipline knowledge: Apply Information Technology knowledge to solve broad-based Information Technology related problems

PO 3- Experiments and practice: Plan to perform experiments and practices to use the results to solve Information Technology related problems.

PO 4- Engineering tools: Apply appropriate Information Technology related techniques/tools with an understanding of the limitations.

III. Competency and Skills

This practical is expected to develop the following skills for the industry identified competency **"Maintain Wireless and Mobile Network".**

1. Use Cupcarbon Simulator.

IV. Relevant Course Outcome(s)

Maintain Adhoc and Wireless sensor Network.

V. Practical Outcome(PrOs)

Simulate WSN node to determine position on node and blink LED using cupcarbon simulator and Sen script.

VI. Relevant Affective Domain Related Outcome(s)

1. Follow safe practices.
2. Handle tools and instruments carefully.
3. Follow ethical practices.

VII. Minimum Theoretical Background

Wireless Sensor Networks (WSNs) are one of the fastest growing control and monitoring technologies in recent years. According to Kumbhar et al., WSNs are destined to be one of the 10 technologies that will change the world and the foreseen future is impregnated by WSNs powered by batteries that will monitor our

environment and even us. WSNs are composed by a set of spatially distributed sensors that are capable of collecting, storing and processing environmental information. Although in their beginnings they were connected by wires, nowadays, WSNs are wirelessly connected with other nodes for communicating and transmitting the collected data. In this sense, the application field of this technology is very broad and can be applied in different areas.

VIII. Work Situation:

a. Faculty will demonstrate the use of cupcaron simulator.
b. Faculty must form a group of two students.
c. Students group will practice cupcaron simulator to simulate WSN node.

IX. Resources required (Additional)

Sr. No.	Instrument /Components	Specification	Quantity	Remarks
1.	IBM PC Compatible Computer System	Suitable specifications as per requirement of simulation software with Latest Processor	1	
2.	Simulation Software	Cupcarbon software		

X. Precautions to be followed

For Simulation

1. Ensure proper earthing to the computer system.
2. Ensure compatibility of computer system with software.
3. Ensure proper installation of simulation software.

Cupcarbon offers two simulation environments

The first simulation environment is a multi-agent environment , which enables the design of mobility scenarios and the generation of events such as fires and gas as well as the simulation of mobiles such as vehicles and flying objects (e.g. UAVs, insects, etc.).The second simulation environment represents a discrete event simulation of wireless sensor networks which takes into account the scenario designed on the basis of the first environment.

CUP CARBON ENVIRONMENT

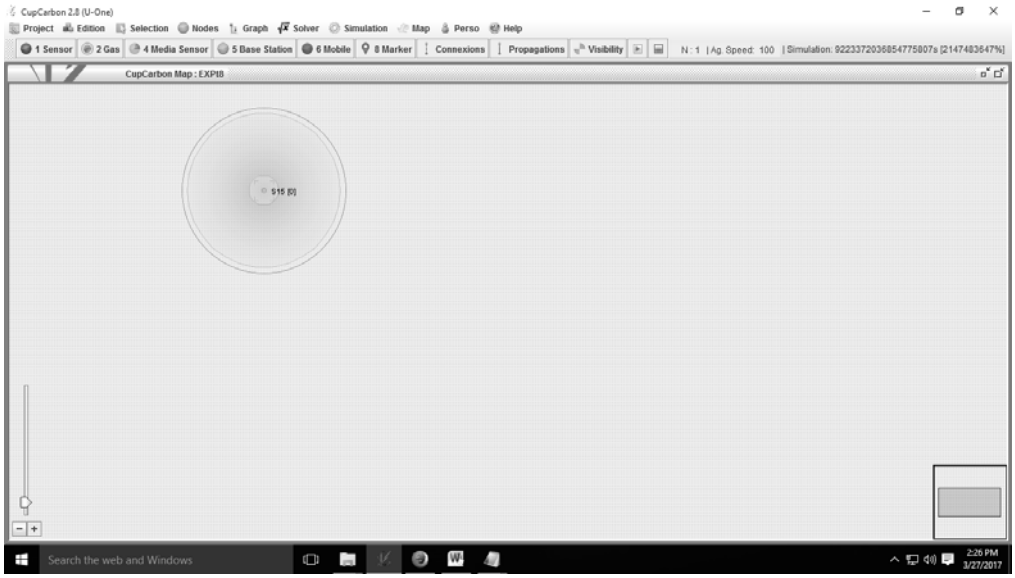
CupCarbon simulation is based on the application layer of the nodes. This makes it a real complement to existing simulators. It does not simulate all protocol layers due to the complex nature of urban networks which need to incorporate other complex and resource consuming information such as buildings, roads, mobility, signals, etc. Moreover, CupCarbon represents the main kernel of the ANR project PERSEPTEUR that aims to develop algorithms for an accurate simulation of the propagation and interference of signals in a 3D urban environment

XI. Procedure

PROJECT 1 : To Display Position of a Sensor Node

1. Create New Project
   Click : Project -> New Project Give any Project Name (Example : WN1)
2. Select Sensor Node

Click : Nodes → Add sensor



3. Create scripts

Click : Simulation -> Communication script

Give a file name (Example : dispose)

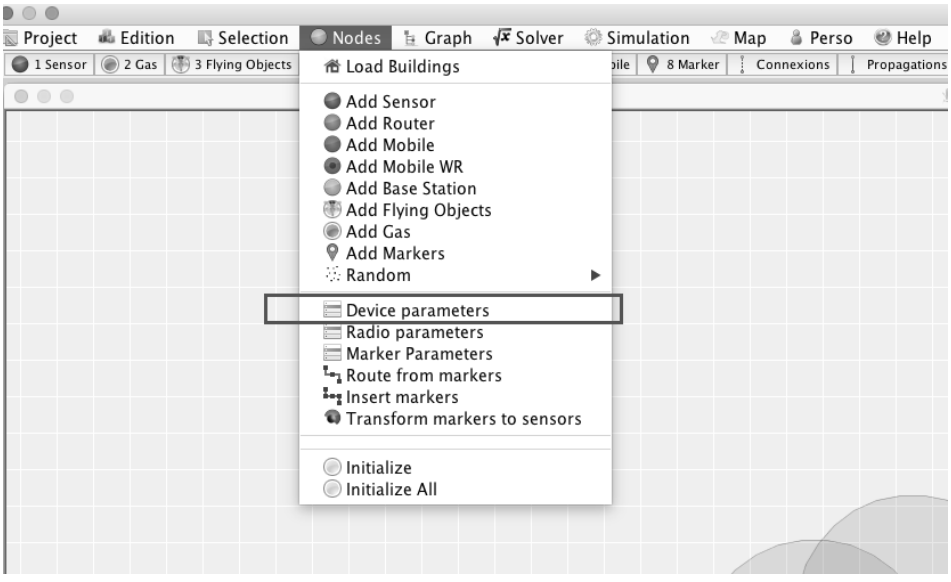
The Senscript to display positions is as below :

```
loop
getpos x
println $x
delay 500
```

4. Script assignment: Device parameters

Assign the script of each sensor.

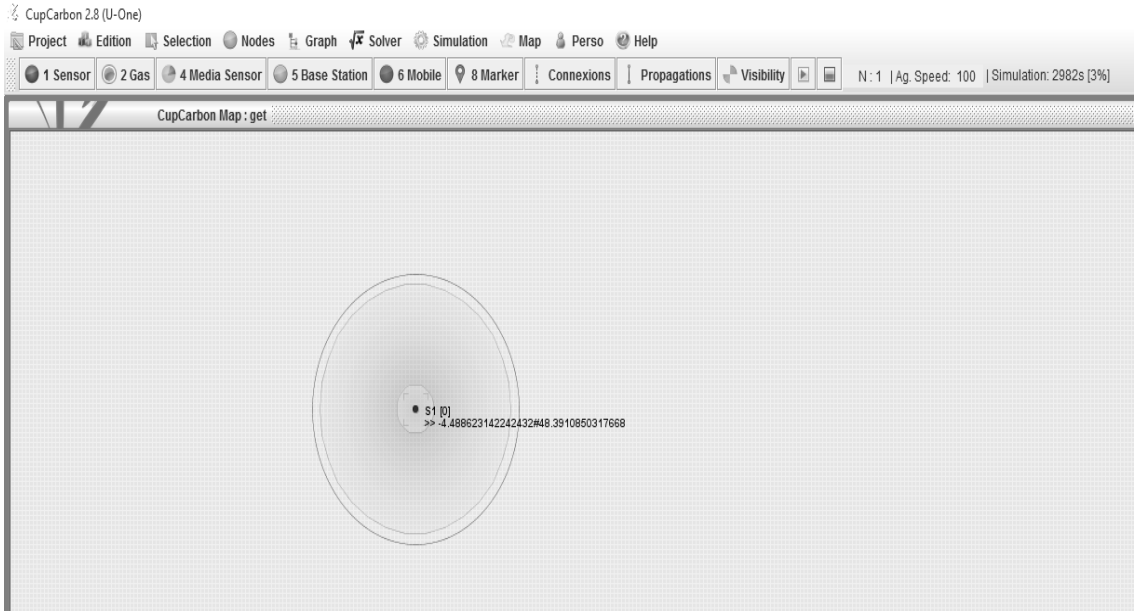
Select a sensor and then click on the item Device parameters in the menu nodes.



Once the device parameter window is opened, click on Enter to display its parameters. Select the corresponding script in the list(Example : dispose) of the Script file and then click on the button (blue arrow) in the right part.

5. Simulate

Open the simulation window: Simulation -> WSN Simulation

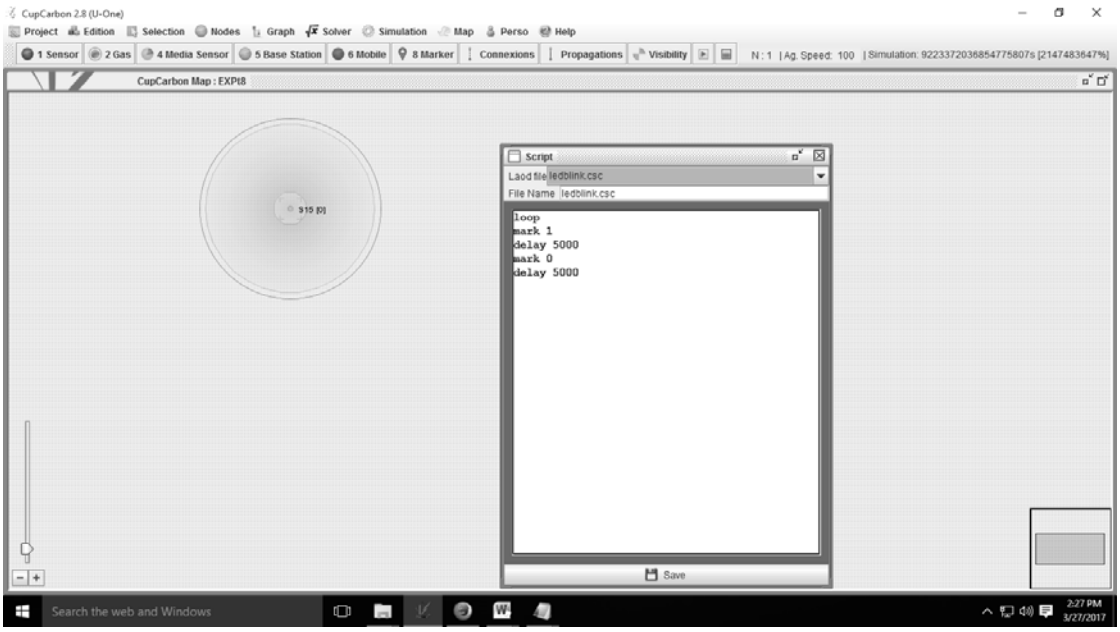


The position of WSN is displayed.

PROJECT 2 : To Blink the Sensor Node(LED)

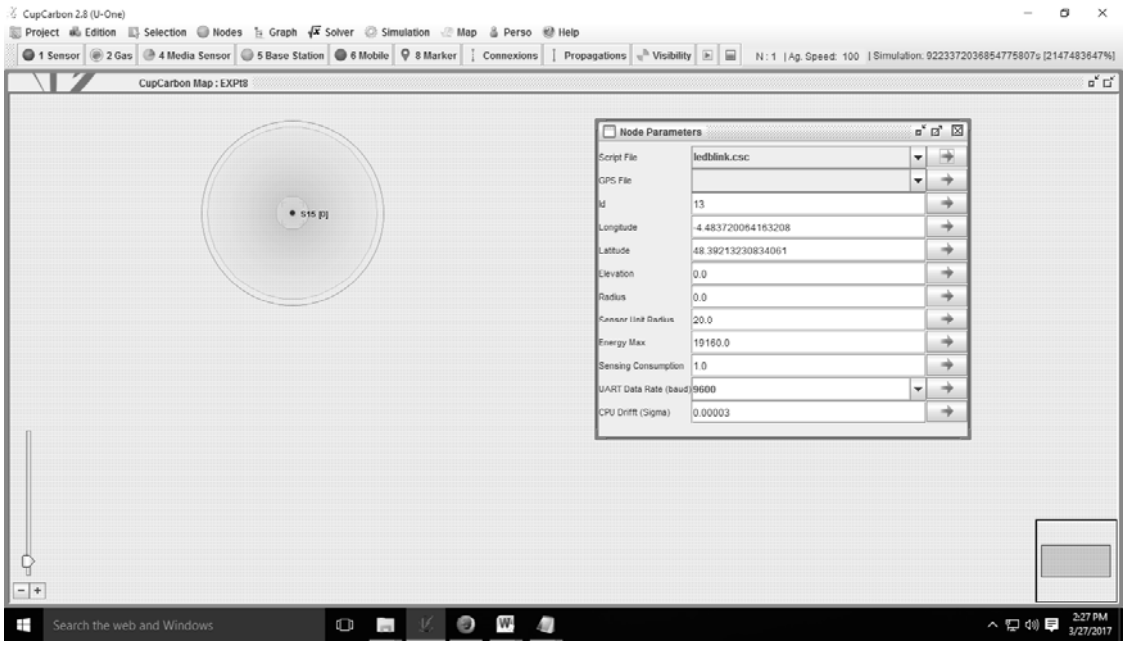
1. Create New Project
   Click : Project -> New Project
   Give any Project Name (Different From previous)(Example : WN2)
2. Select Sensor Node
   Click : Nodes → Add sensor
3. Create scripts
   Click : Simulation -> Communication script
   Give a suitable Filename (Example : blinkled1)
   The Senscript to display positions is as below :

```
loop
mark 1
delay 1000
mark 0
delay 1000
```



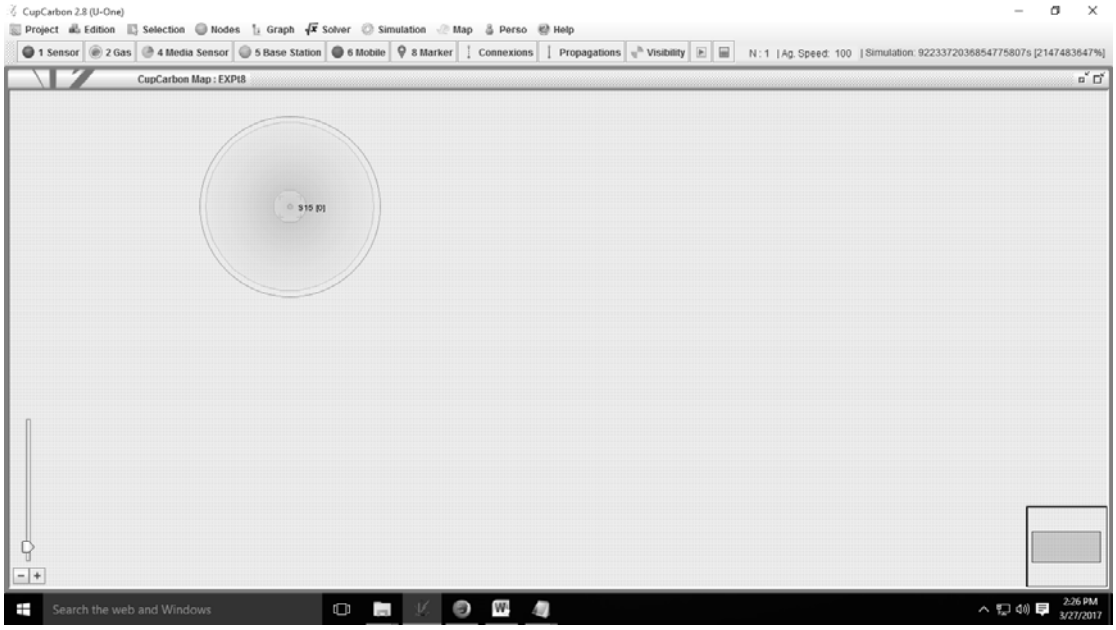
4. Script assignment: Device parameters

- Assign the script of each sensor.
- Select a sensor and then click on the item Device parameters in the menu nodes.
- Once the device parameter window is opened, click on Enter to display
- its parameters.
- Select the corresponding script in the list of the Script file and then click on
- the button (blue arrow) in the right part.



5. Simulate

Open the simulation window: Simulation -> WSN Simulation



The LED blinks .

XII. Resources used (Additional)

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XIII. Conclusion

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XIV. Actual Simulation and Output Observed

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XV. Interpretation of result

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XVI. Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions to ensure the achievement of identified CO.

1. What are different simulation software used in WSN.
2. Compare various Hardware Sensor boards

(Space for answers)

XVII. Exercise

(Use blank space provide for answers or attached more pages if needed)

1. Write Program to print Hello World using Cupcarbon simulator.
2. Write program to print table of 7.
3. Write program to mark LED, blink LED and change the colours of LED using Cupcarbon simulator.

(Space for answers)

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XVIII. References / Suggestions for further Reading

1. https://www.elprocus.com/8086-assembly-language-programs-explanation/
2. http://mysc.altervista.org/beginners-guide-8086/
3. https://www.tutorialspoint.com/assembly_programming/

XIX. Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of Software	20%
2	Building of diagram	20%
3	Working in team	20%
Product related (10 Marks)		**40%**
4	Practical related questions	20%
5	Completion and submission of practical in time	10%
6	Expected Output/Observation	10%
	Total (25 Marks)	**100%**

List of student Team Members

1. ……..
2. ……...
3. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	