K.L.E Society's

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CONTENTS

STAFF IN-CHARGE H.O.D. PRINCIPAL

Expt No:- 1

Aim:- To generate ASK & demodulate the signal.

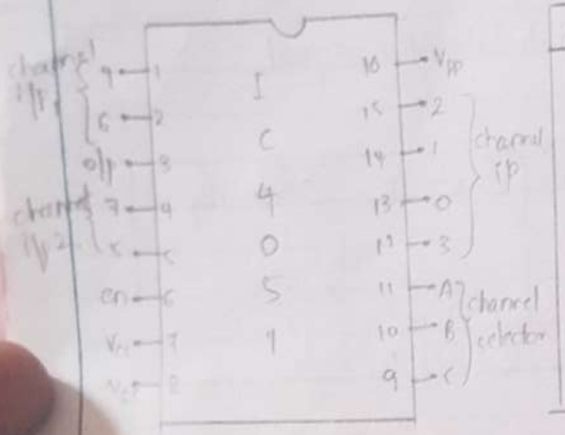
Equipments required:-

Sl No	Name of components	value	Quantity
1	IC4051	-	1
2	IC741	-	1
3	Resistors	1kΩ	1
4	Capacitor	0.01μf	1

Theory:- Amplitude shift keying is a form of ~~ap~~ amplitude modulation that represents digital data as variations in the amplitude of carrier wave. In ~~an~~ ASK system, the binary symbol represented by transmitting a fixed amplitude carrier, wave & fixed frequency for a bit direction of T sec if the signal value is then the carrier signal will be transmitted otherwise a signal value of a will be transmitted. Any digital modulation scheme user a finite no. of distinct signals to represent digital data ASK user a finite no. of amplitudes. Each assigned a unique pattern of binary digit usually, each amplitude encoder as equal no. of bits. Each pattern of bits forms the symbol that is represented by perticular amplitude.

The demodulation which is designed respectively for the symbol-set used by the modulator, determines the amplitude of the received signal & maps it back to the signal it represents, then recovering the original data frequency & phase of the carrier are kept constant.

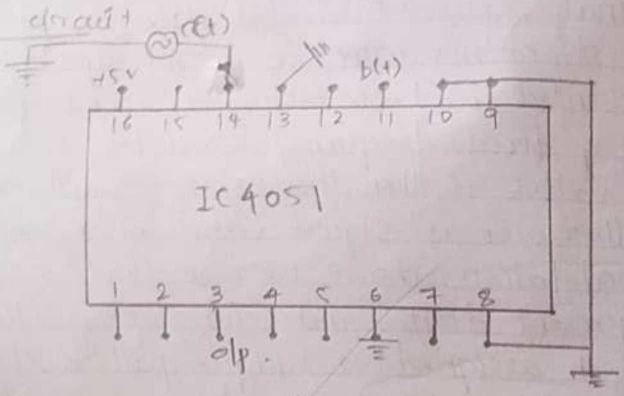
Pin configuration



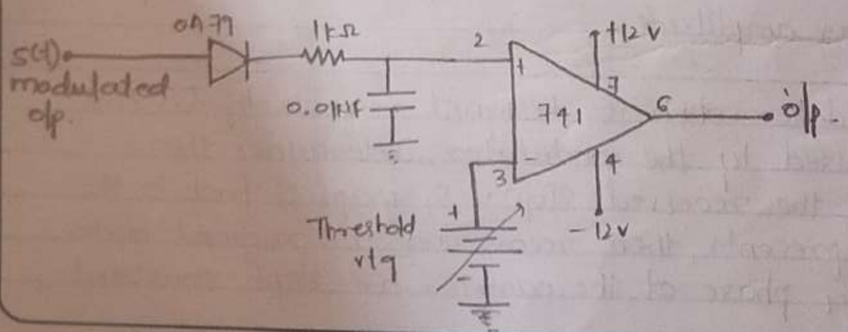
channel selection table.

c[9]	B[10]	c[11]	channel i/p pt.
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

Modulation circuit



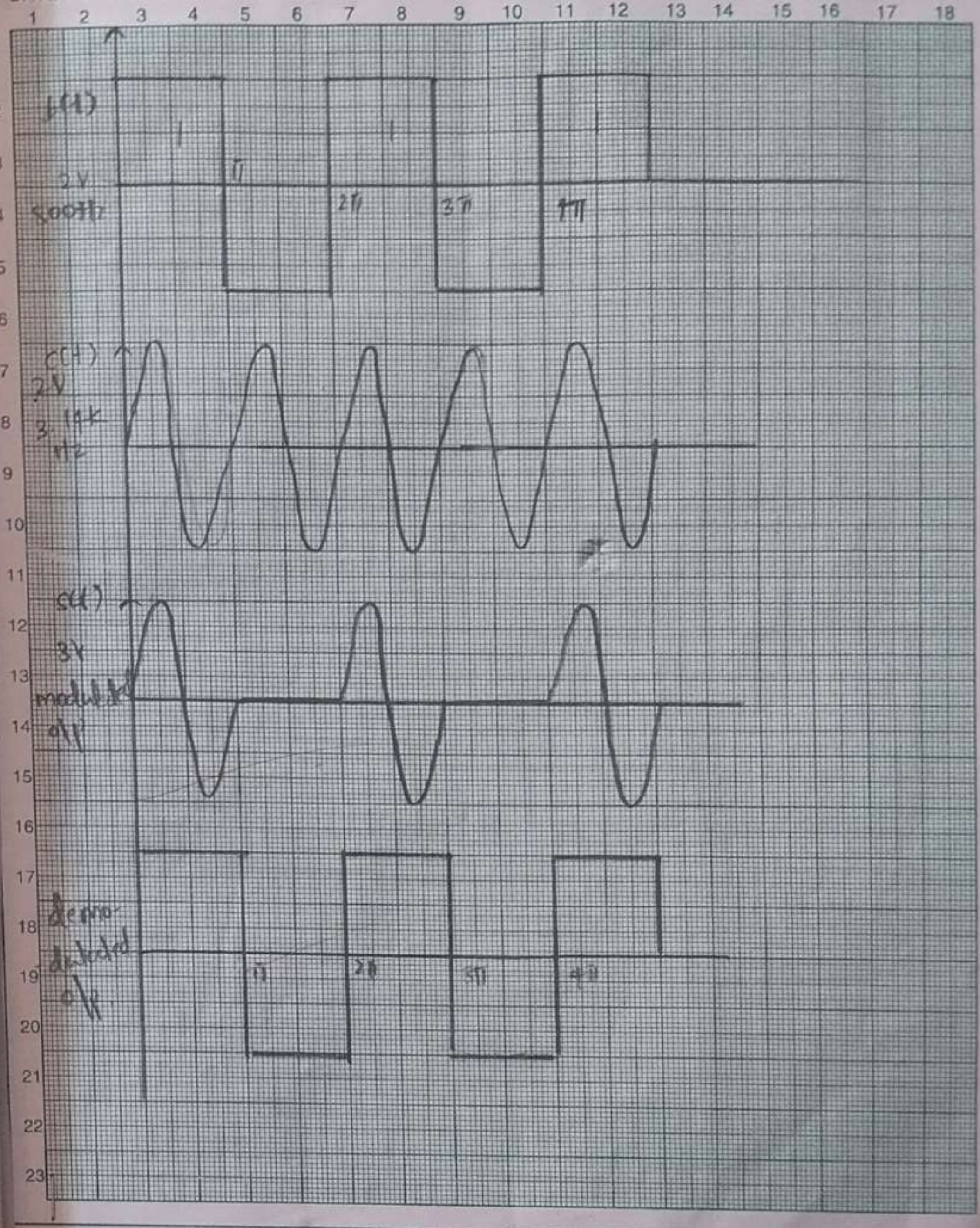
Demodulation circuit



EXPERIMENT NO. : 1

DATE :

SCALE : X-axis : 2 unit = 2ms
Y-axis : 2 unit = 1V



Procedure :-

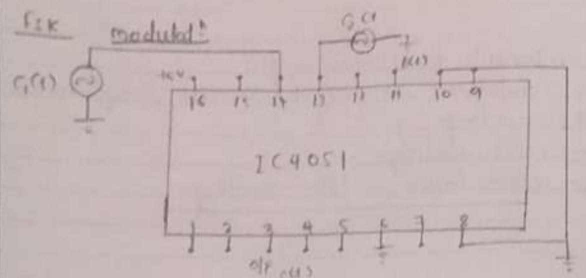
1. Check the components for probes output.
2. Connect the components as per the circuit diagram.
3. Tabulate the readings.
4. Take concurrent readings.
5. Observe the wave forms & take readings.

* Results :-

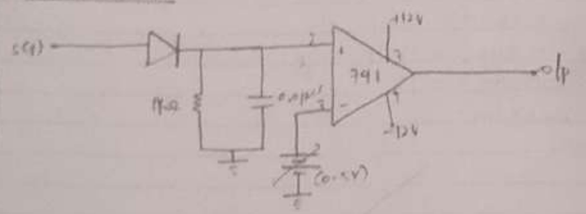
Threshold voltage = 0.7V
$b(t) = 2V_{p-p} = 500Hz$
$c(t) = 2V_{p-p} = 3.14 KHz$
output $s(t) = 0.3 V_{p-p} = 3KHz$
Threshold voltage = 0.7V
delay = 0.2 × 1ms
D = 0.2 ms

Conclusion :-
ASK modulation & demodulation is designed and verified.

FSK modulator



Demodulation:



Experiment No: 2

Aim: To design & verify the operation of FSK generation & dectector.

Components required :

Sl. No	Name of the components	Quantity	Specification
1.	IC4051	1	—
2.	IC741	1	—
3.	Resistors	1	4.7 kΩ
4.	capacitors	1	0.01μF
5.	IN4007	1	

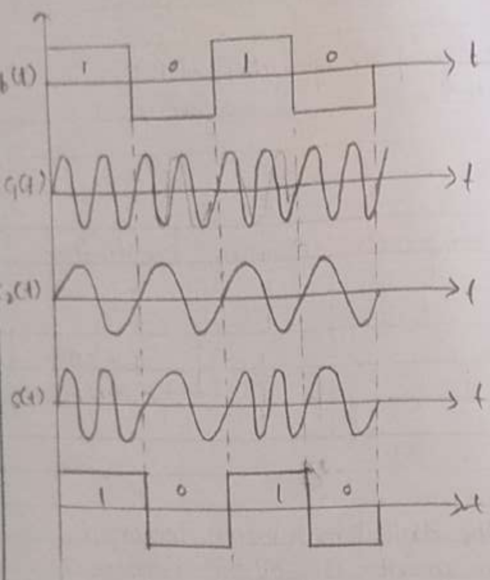
Theory:

FSK is one of the digital modulation technique. Here frequency of the carrier is switched between 2 value. A signal of amplitude, a frequency f_{c_1} is used to represent a binary '1' & frequency f_{c_2} is used to represent binary '0'. FSK modulated waveform can be represented as

$$s(t) = \begin{cases} A_c \cos(2\pi f_{c_1} t) & \text{for symbol '1'} \\ A_c \cos(2\pi f_{c_2} t) & \text{for symbol '0'} \end{cases}$$

Procedure:

1) Check the required components for proper function.
2) Set up the circuit as per the circuit diagram.



Outputs

Modulation

$b(t) = 2\,V_{(p-p)} = 500\,Hz$

$C_1(t) = 4V_{(p-p)} = 9\,kHz$

$C_2(t) = 2\,V_{(p-p)} = 3\,KHz$

output $s(t) = 3.6\,V_{(p-p)}$

Demodulation

Delay = 0.1

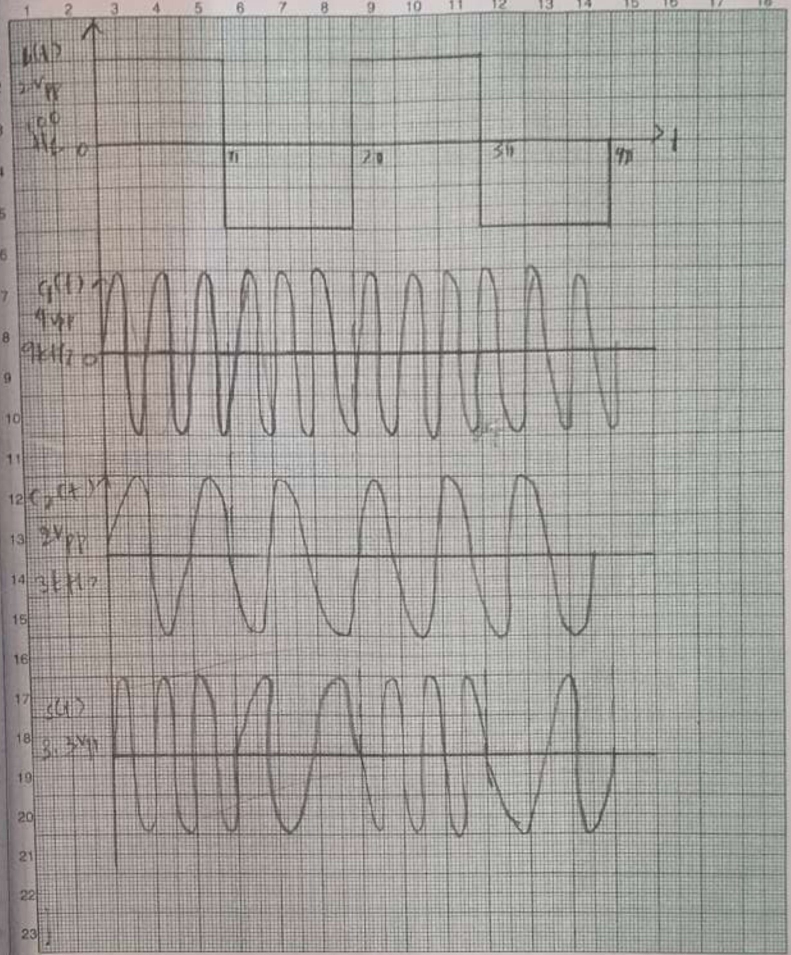
frequency = $\frac{1}{1ms}$

$\boxed{f = 1\,kHz}$

EXPERIMENT NO.: 2

DATE:

SCALE: X-axis: 1 unit = 0.5ms
Y-axis: 1 unit = 1V.



- Apply the message signal of amplitude 2 V_{p-p} & frequency 1KHz.
- Observe ASK output at code transmitter's collector also above FSK o/p at pin 6.
- Connect the demodulator circuit.
- observe ASK & demodulator output on CRO.

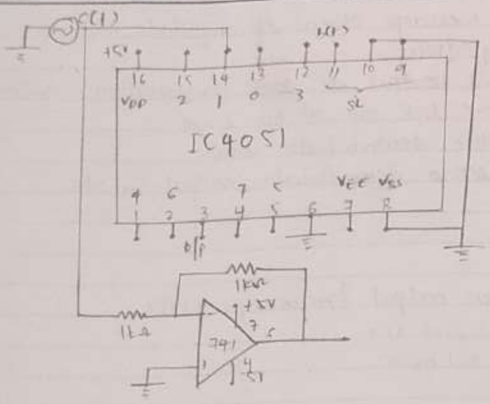
Result:

Demodulation output frequency = 1KHz
$s(t) = 3.6 V_{p-p}$
Delay = 0.1 msec.

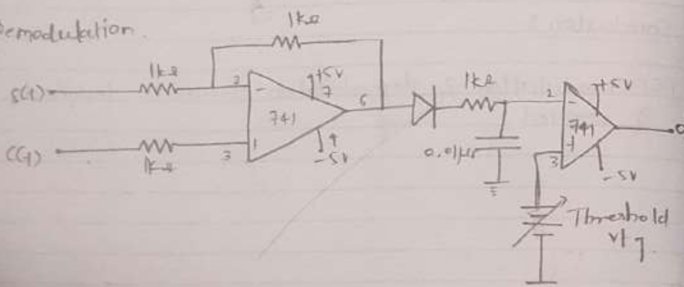
* Conclusion :-

FSK modulation & demodulation circuit is designed & verified.

PSK.



Demodulation.



Experiment - 3

Aim: To generate PSK modulation signal.

Components required:

Sl No.	Name of the components	Quantity
1	IC 4051	1
2	IC741	~~8~~1
3	Resistors - 1kΩ	2

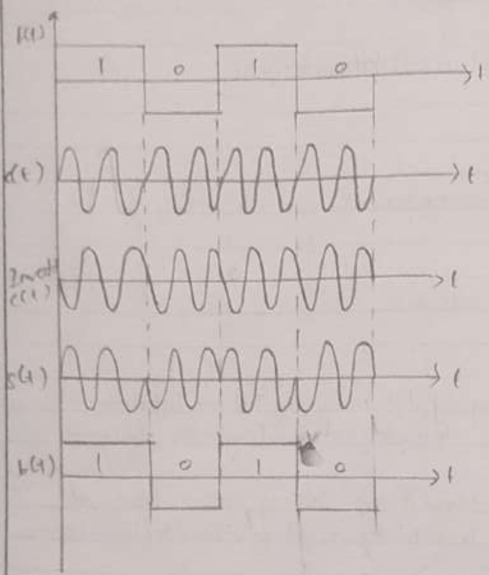
Theory:

Phase - Shift keying (PSK) is a digital modulation scheme that data by changing (modulation) the phase of a reference signal.

The signal to improved the sine & cosine inputs at precise the time. It is widely used for bluetooth communication.

Any digital modulation scheme used a finite number of distinct signals to represent digital data. PSK uses a finite no. of phases, each assigned a unique pattern of binary digits. Usually, each phase encodes an equal number of bits.

Then receivers to be able to compare the phase of the required signal to a reference signal ~~t~~ such that a system is termed inherent.



Outputs:

modulation

$b(t) = 2V_{pp} - 500Hz$

$c(t) = 2V_{pp} = 3kHz$

$s(t) = 1.8\ V_{pp}$

Demodulation

delay $= 0.2 \times 0.2m = 0.4ms$.

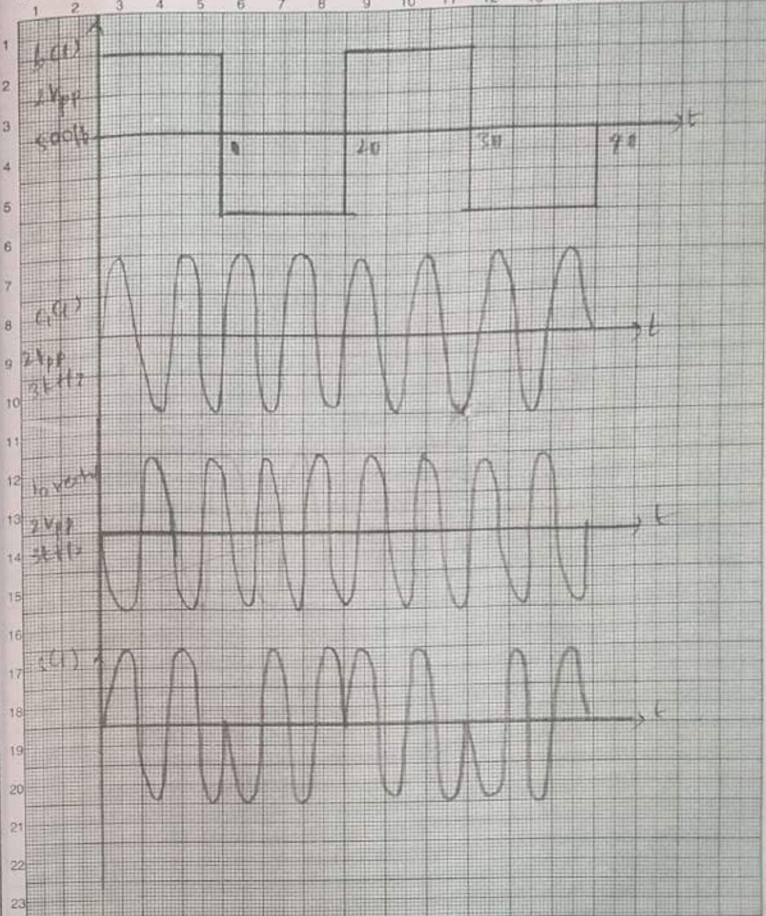
$f = \frac{1}{T} = \frac{1}{0.4m} = 2.5kHz$.

EXPERIMENT NO.: 3

DATE :

SCALE : X - axis : 3 unit = 2ms

Y - axis : 1 unit = 1V



* Procedure:-

1) Check the components for proper functioning.
2) Connect the components as per circuit.
3) Then observe the output.
4) Tabulate the results.

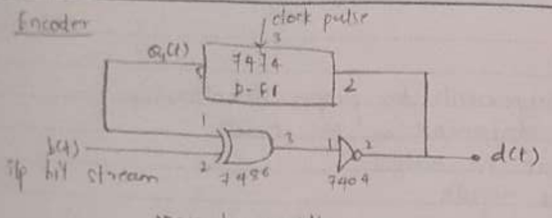
* Results:

$s(t) = 1.8 \, V_{p-p}$
delay = 0.4 m sec
frequency = 25 kHz
Threshold voltage = 0.2V

* Conclusion:

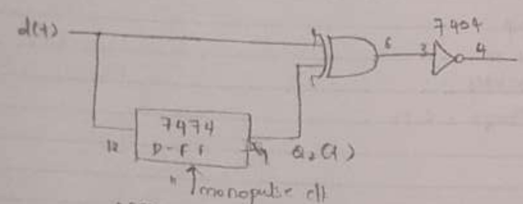
PSK modulation & demodulation is designed and verified.

Encoder



DPSK transmitter

Decoder



DPSK receiver.

observation Table

Sl. No	Bit stream	$Q_1(t)$	Encoded bit	delayed bit $Q_2(t)$	detected bit b(t)
1	0	0	1	0	0
2	0	1	0	1	0
3	0	0	1	0	0
4	0	1	0	1	0
5	1	0	0	0	1
6	1	0	0	0	1
7	1	0	0	0	1
8	0	0	1	0	0
9	1	1	1	1	1
10	1	1	1	1	1
11	0	1	0	1	0
12	1	0	[illegible]	[illegible]	[illegible]

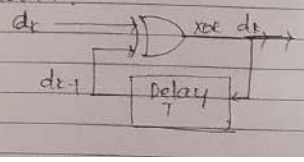
Experiment No: 4

Aim: Generation of DPSK and detection of data using DPSK transmitter and receiver.

Components required

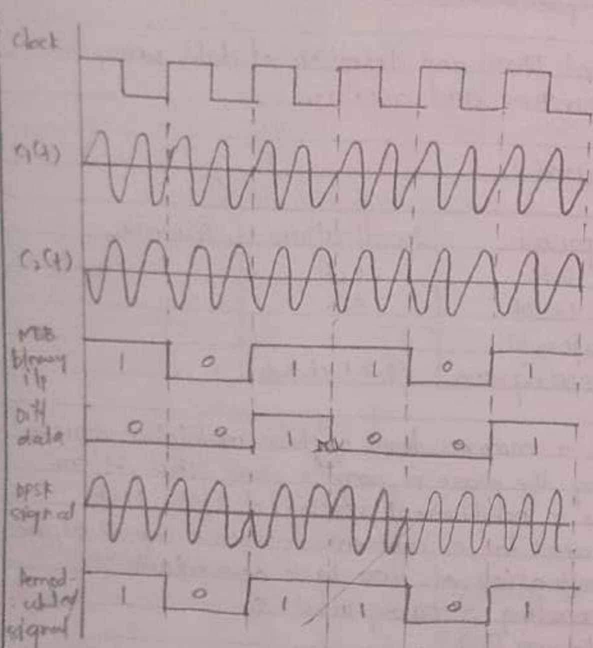
Sl. No	Components	Specifications	Quantity
1	IC D FF	7474	1
2	IC Ex-OR	7486	1
3	Trainer kit	-	1
4	connecting wires	Patch chords	

Theory: DPSK is a common form of phase modulation conveys data by changing the phase of carrier wave. Thus, it can be regarded as a noncoherent version of BPSK. DPSK eliminates the need for a coherent reference signal at the receiver by combination of two basic operations:
(i) Differential encoding of binary input &
(ii) Phase Shift Keying (PSK).
For symbol '0', a carrier signal with 180° phase shift is transmitted & for symbol '1' a carrier signal with 0° phase shift (phase unchanged) is transmitted. Binary i/p data with arbitrary bit as reference is encoded with XOR encoder.



a_k	d_{k-1}	d_k
0	0	0
0	1	1
~~0~~1	0	1

Waveforms



Procedure:

1. Connections are made as per circuit diagram.
2. The input bit stream b(t) & monopulse are applied & output of the encoder is observed & verified as per circuit diagram.
3. Now apply the output of the encoder as input to the decoder circuit & observe the message bit stream with or & verify the bit stream with original bit stream that was transmitted.

* Conclusion:

The generation of DPSK & detection of data using DPSK transmitter & receiver is designed and verified.

Output:-

Orthonormal basis vectors :-

0.7071	0.4082	-0.5774
0.7071	-0.4082	0.5774
0	0.8165	0.5774

Plot :-

The plot shows the original vectors & the orthonormal vectors in 3D coordinate system.
The red, green & blue ~~ar~~ arrows represent the original vectors.
The dashed arrows in the same colour represent the orthonormal vectors.

Experiment No :- 5

Aim :- Gram-Schmidt Orthogonalization – To find orthogonal basis vectors for given set of vectors & plot the orthonormal vectors.

Software Used : Matlab 2024

Theory :- The Gram-Schmidt ~~ot~~ orthogonalisation procedure is a method used in linear algebra to transform a set of linearly independent vectors in an orthogonal (or orthonormal) set. It is particularly useful when working with vector spaces & helps in creating an orthogonal basis for a subspace.

Code :-

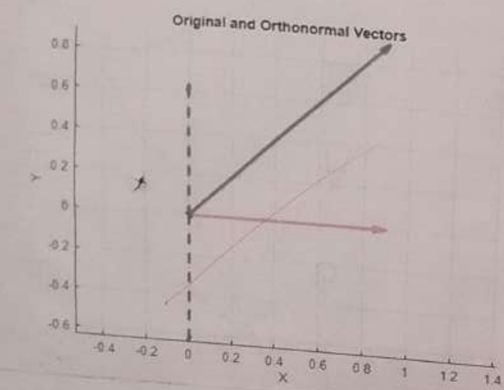
```
% Given set of vectors as columns;
V=[1 0 0; 1 1 1; 0 0 1];
num_vectors = size(V,2);
U= zeros(size(V));
E = zeros(size(V));
U(:,1)= V(:,1); % First orthogonal vector is the first i/p.
E(:,1) = U(:,1)/norm(U(:,1)); % 1st orthonormal vector
for i = 2:num_vectors
   U(:,i) = V(:,i);
   for j = 1:i-1
      U(:,i) = U(:,i) - dot(V(:,i), E(:,j))* E(:,j));
   end
   E(:,i)= U(:,i)/norm(U(:,i));
end
disp('Orthonormal basis vectors: ');
disp(E);
```

EXPERIMENT 5

2KE22EC095

```
Orthonormal basis vectors:

    1.0000         0         0
         0    0.7071   -0.7071
         0    0.7071    0.7071
```




```
figure;
hold on;
grid on;
axis equal;
quiver3(0,0,0,V(1,1),V(2,1),V(3,1),'r','LineWidth',2);
quiver3(0,0,0,V(1,2),V(2,2),V(3,2),'g','LineWidth',2);
quiver3(0,0,0,V(1,3),V(2,3),V(3,3),'b','LineWidth',2);
xlabel('X');
ylabel('Y');
zlabel('Z');
legend('Original V1','Original V2','Original V3',
    'Orthonormal E1','Orthonormal E2','Orthonormal E3');
title('Original and orthonormal vectors');
hold off;
```

* Conclusion:-

The Gram-Schmidt orthogonalisation to find orthogonal basis vector & plot orthonormal vector has been performed & verified.