STUDENT LAB SAFETY, HIRARC, DATASHEET VERIFICATION CHECKLIST, AND BRIEF REPORT SUBMISSION

EXPERIMENT CM9: DIGITAL MODULATION USING MATLAB

STUDENT NAME : _____
MATRIC NO. : _____
GROUP : _____
DATE : _____

A. Software and Simulation Verification Checklist
Complete the checklist before recording the final simulation results.

Item	Verification Requirement	✓
MATLAB	MATLAB 2017a/b or a compatible later version launched successfully	☐
Working Folder	Dedicated CM9 experiment folder created	☐
MATLAB Script	Supplied MATLAB code entered or loaded correctly	☐
Script Examination	MATLAB code examined before execution	☐
Script Execution	Script runs without unresolved errors	☐
Binary Sequence 1	1 0 1 1 0 0 1 entered correctly	☐
ASK Modulation	ASK signal generated successfully	☐
FSK Modulation	FSK signal generated successfully	☐
PSK Modulation	PSK signal generated successfully	☐
Baseband Signal	Digital baseband waveform displayed correctly	☐
Passband Signals	ASK, FSK, and PSK passband forms displayed	☐
Constellation Diagrams	Required constellation diagrams generated	☐
Parameters	Key modulation parameters identified and recorded	☐
Parameter Variation	Selected parameters varied systematically	☐
ASK Demodulation	Recovered binary sequence verified	☐
FSK Demodulation	Recovered binary sequence verified	☐
PSK Demodulation	Recovered binary sequence verified	☐
Binary Sequence 2	1 1 0 1 0 1 0 entered correctly	☐
Repeated Experiment	Complete experiment repeated using Sequence 2	☐
Plot Presentation	Titles, axes, units, and legends included	☐
Results	Required observations and plots recorded	☐
File Management	MATLAB script and report saved and backed up	☐

Verification Outcome

Verification Status	✓
All requirements completed satisfactorily	☐
Minor corrections required before recording results	☐
Simulation approved to proceed	☐

B. HIRARC Checklist

Hazard or Unsafe Condition	Potential Consequence	Control Measure	✓
Damaged workstation equipment	Electric shock or equipment damage	Inspect equipment and report visible damage	☐
Food or drinks near computer	Short circuit or equipment damage	Keep food and drinks away from equipment	☐
Loose workstation cables	Tripping or accidental disconnection	Maintain an organized working area	☐
Poor working posture	Physical discomfort and fatigue	Adjust chair, screen, and sitting position	☐
Prolonged screen exposure	Eye strain and reduced concentration	Take appropriate periodic breaks	☐
Incorrect MATLAB syntax	Simulation failure	Check error messages and correct the script	☐
Incorrect binary sequence	Invalid modulation and demodulation results	Verify the sequence before simulation	☐
Incorrect time or bit settings	Distorted digital waveforms	Verify bit duration and time vector	☐
Insufficient sampling frequency	Poor waveform representation or aliasing	Check the sampling frequency against the carrier frequencies	☐
Incorrect carrier parameters	Invalid ASK, FSK, or PSK waveform	Verify amplitudes, frequencies, and phases	☐
Inappropriate parameter changes	Misleading comparison	Change one parameter at a time and record its value	☐
Incorrect decision threshold	Bit-detection errors	Verify threshold against expected signal levels	☐
Incorrect demodulation logic	Incorrect recovered sequence	Compare detected bits with transmitted bits	☐
Unlabelled simulation plots	Misinterpretation of results	Include titles, axes, legends, and parameter values	☐
Failure to save files	Loss of simulation work	Save and back up files regularly	☐
Alteration or fabrication of results	Breach of engineering ethics	Report actual MATLAB results only	☐
Copying another student's work	Academic misconduct	Submit independently generated work	☐

Risk level after control measures: ☐ Low ☐ Medium ☐ High

C. Engineering Practice Verification
Complete this checklist after obtaining the simulation results.

Engineering Practice Requirement	✓
Governing principles of ASK, FSK, and PSK reviewed	☐
Mathematical equation for each modulation method identified	☐
Original binary sequence recorded correctly	☐
Bit duration and bit rate verified	☐
Sampling frequency and time vector checked	☐
ASK carrier amplitude and frequency verified	☐
FSK frequencies for binary 0 and binary 1 verified	☐
PSK phase states for binary 0 and binary 1 verified	☐
Baseband waveform generated correctly	☐
ASK passband waveform generated correctly	☐
FSK passband waveform generated correctly	☐

PSK passband waveform generated correctly	☐
Required constellation diagrams produced and labelled	☐
Key ASK parameters varied systematically	☐
Key FSK parameters varied systematically	☐
Key PSK parameters varied systematically	☐
ASK demodulation result verified	☐
FSK demodulation result verified	☐
PSK demodulation result verified	☐
Recovered bits compared with transmitted bits	☐
Complete experiment repeated using the second sequence	☐
Effects of changing the binary sequence analysed	☐
Time-domain results compared with modulation theory	☐
Constellation results interpreted correctly	☐
Figures contain readable titles, axes, units, and legends	☐
Results supported by actual MATLAB outputs	☐
Unexpected results investigated and discussed	☐
Simulation and report files saved and backed up	☐
Engineering ethics and data integrity maintained	☐

Engineering Practice Outcome

Verification Statement	✓
Simulation follows acceptable engineering practice	☐
Results have been checked against theoretical expectations	☐
Demodulation results agree with the transmitted data	☐
Experiment is ready for reporting and assessment	☐

D. Student Declaration

I confirm that:

☐ The supplied MATLAB script was examined before execution.

☐ The binary sequences, bit duration, sampling frequency, carrier amplitude, carrier frequency, and phase values were checked.

☐ The operation of Amplitude Shift Keying, Frequency Shift Keying, and Phase Shift Keying was studied.

☐ The theoretical equations for ASK, FSK, and PSK were identified and related to the MATLAB implementation.

☐ The baseband and passband forms of the digitally modulated signals were generated.

☐ The required constellation diagrams were generated and interpreted.

☐ The key parameters affecting ASK, FSK, and PSK were identified.

☐ Selected parameters were varied systematically, and the resulting waveform changes were recorded.

☐ ASK, FSK, and PSK demodulation processes were completed.

☐ The recovered binary sequences were compared with the transmitted sequences.

☐ The initial binary sequence, 1 0 1 1 0 0 1, was simulated and analysed.

☐ The complete experiment was repeated using the binary sequence 1 1 0 1 0 1 0.

☐ Differences between the two simulation cases were evaluated.

☐ All time-domain plots and constellation diagrams were obtained from actual MATLAB results.

☐ Figures were labelled with suitable titles, axes, units, legends, and parameter values.

☐ Unexpected simulation or demodulation results were investigated and reported honestly.
☐ The MATLAB script and report were saved using identifiable filenames and backed up.
☐ The submitted simulation, figures, observations, and explanations represent my own work.
☐ Engineering ethics, data integrity, and academic integrity were maintained throughout the experiment.

Student Signature : _____

Date : _____

E. Experimental Data, Results and Discussion

E1. Simulation Parameters

Parameter	Symbol	Initial Value	Unit
Binary Sequence 1	x_1	1 0 1 1 0 0 1	bit
Binary Sequence 2	x_2	1 1 0 1 0 1 0	bit
Number of bits	N_b	7	bit
Bit duration	T_b		s
Bit rate	$R_b = 1/T_b$		bit/s
Sampling frequency	f_s		Hz
Samples per bit	N_s		sample/bit
Carrier amplitude	A_c		V
ASK carrier frequency	f_c		Hz
FSK frequency for bit 1	f_1		Hz
FSK frequency for bit 0	f_0		Hz
PSK phase for bit 1	ϕ_1		rad
PSK phase for bit 0	ϕ_0		rad

E2. Modulation and Demodulation Results

Method	Key Parameters	Main Modulation Observation	Recovered Sequence	Correct?
ASK, Sequence 1	$A_1 =$___, $A_0 =$___, $f_c =$___			☐
FSK, Sequence 1	$f_1 =$___, $f_0 =$___			☐
PSK, Sequence 1	$\phi_1 =$___, $\phi_0 =$___			☐
ASK, Sequence 2	$A_1 =$___, $A_0 =$___, $f_c =$___			☐
FSK, Sequence 2	$f_1 =$___, $f_0 =$___			☐
PSK, Sequence 2	$\phi_1 =$___, $\phi_0 =$___			☐

E3. Parameter-Variation Results

Modulation	Parameter Varied	Values Tested	Main Effect Observed	Selected Value
ASK	Amplitude level or threshold			
ASK	Carrier frequency			
FSK	f_1 and f_0 separation			

FSK	Carrier amplitude			
PSK	Phase difference			
PSK	Carrier frequency			

E4. Sequence Comparison

Comparison Item	Sequence 1	Sequence 2	Observation
Input bits	**1 0 1 1 0 0 1**	**1 1 0 1 0 1 0**	**Different bit arrangement**
Number of binary 1s			
Number of binary 0s			
ASK waveform			
FSK frequency changes			
PSK phase transitions			
ASK recovered bits			
FSK recovered bits			
PSK recovered bits			
Bit errors detected			

E6. Demodulation Verification

Modulation	Transmitted Bits	Recovered Bits	Number of Bit Errors	Demodulation Status
ASK				
FSK				
PSK				

Calculate the measured bit-error proportion:

$$\mathbf{BER} = \frac{\textbf{Number of incorrectly detected bits}}{\textbf{Total number of transmitted bits}}$$

DISCUSSION:

CONCLUSION:

LAB LECTURER
SIGNATURE : _____

DATE : _____

INSTRUCTOR
SIGNATURE : _____

DATE : _____