Experiment no.: **Date of Performance:**

Title: Study of QPSK transmitter & receiver using suitable setup/kit.

Objectives: 1) To study building block of QPSK transmitter
2) To study building block of QPSK receiver

Equipment's: 1) Experimental Kit
2) Power supply
4) DSO 20MHz
4) connecting cables

Theory:

QPSK Generation:

Quadrature phase shift keying (QPSK) is another modulation technique, and it's a particularly interesting one because it actually transmits two bits per symbol. In other words, a QPSK symbol doesn't represent 0 or 1—it represents 00, 01, 10, or 11.

This two-bits-per-symbol performance is possible because the carrier variations are not limited to two states. In ASK, for example, the carrier amplitude is either amplitude option A (representing a 1) or amplitude option B (representing a 0). In QPSK, the carrier varies in terms of phase, not frequency, and there are *four* possible phase shifts.

We can intuitively determine what these four possible phase shifts should be: First we recall that modulation is only the beginning of the communication process; the receiver needs to be able to extract the original information from the modulated signal. Next, it makes sense to seek maximum separation between the four phase options, so that the receiver has less difficulty distinguishing one state from another. We have 360° of phase to work with and four phase states, and thus the separation should be 360°/4 = 90°. So our four QPSK phase shifts are 45°, 135°, 225°, and 315°.

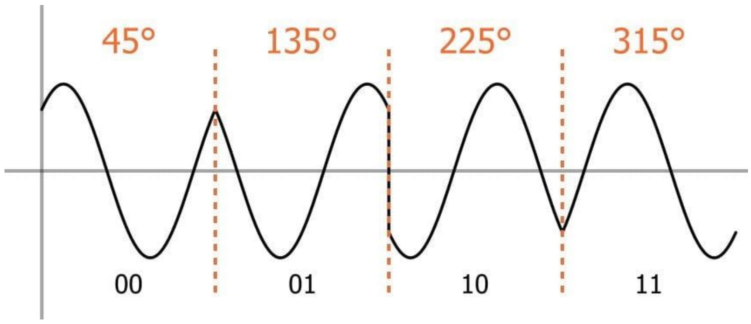

Fig.1 QPSK waveform

(Note: The phase-shift-to-digital-data correspondence shown in fig.1 is a logical though arbitrary choice; as long as the transmitter and receiver agree to interpret phase shifts in the same way, different correspondence schemes can be used.)

There's another reason why it makes sense to choose 45°, 135°, 225°, and 315°: they are easily generated using I/Q modulation techniques because summing I and Q signals that are either inverted or noninverted results in these four phase shifts. The following table should clarify this:

I	Q	phase shift of I+Q
noninverted	noninverted	45°
inverted	noninverted	135°
inverted	inverted	225°
noninverted	inverted	315°

Fig.2 QPSK phase shifts

QPSK Transmitter:

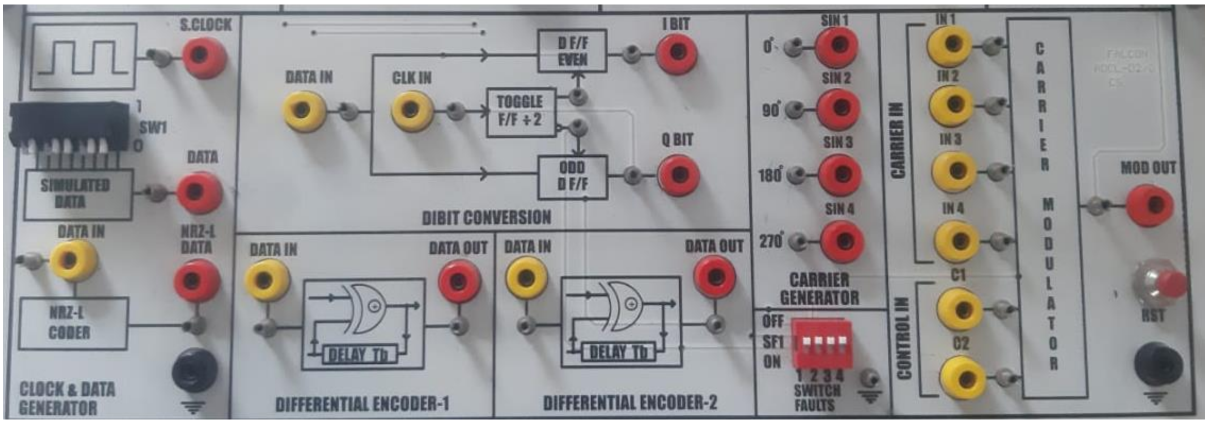

Fig. 3 QPSK Transmitter

Procedure:

1) Crete data sequence by adjusting pins of switch SW1
2) Connect simulated data from SW1 to NRZ block input.
3) Connect NRZ block output to DIBIT CONVERSION input DATA IN
4) Connect all four phases from carrier generator to IN1, IN2, IN3, IN4 inputs of carrier modulator.
5) Connect I bit and Q bit from DIBIT CONVERSION to CONTROL IN C inputs of C1, C2 respectively carrier modulator.

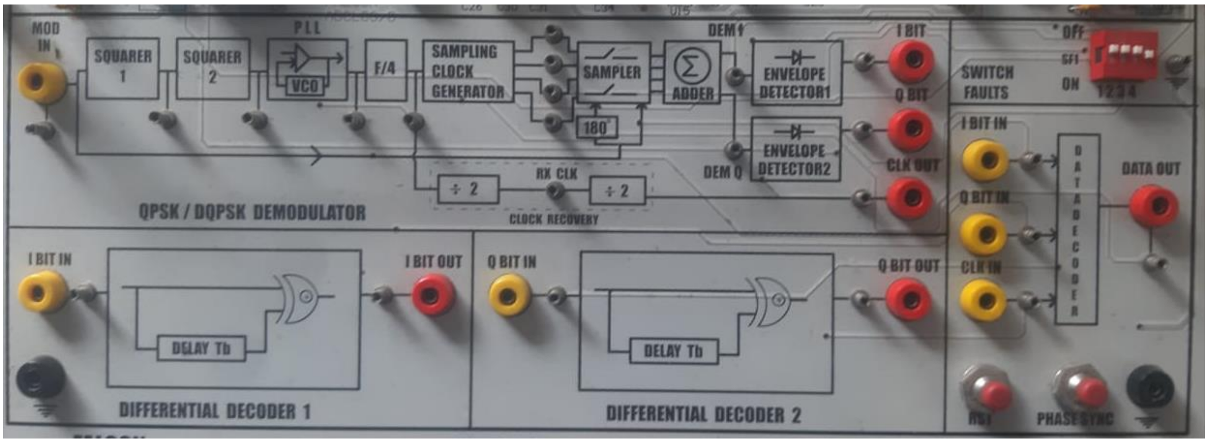

Fig.3 QPSK Receiver

Observations:

1) Observe the four phases generated from carrier generator
2) Observe the I-bit and Q-bit from DIBIT CONVERSION
3) Observe the QPSK modulated output

Conclusion: ______________________________

Name of Teaching Staff:	**Signature**