

Name:

Enrolment No:



**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**End Semester Examination, May 2018**

**Course: Digital Communication**  
**Program: B. Tech (Electronics Engineering)**  
**Time: 03 hrs.**

**Semester: VI**  
**Max. Marks: 100**

**Instructions: Attempt all questions.**  
**Answer must be brief and to the point.**  
**Diagrams must be neat and clean**

**SECTION A**

S. No.		Marks	CO
Q 1	Define <b>Nyquist theorem</b> of <b>sampling</b> . Find the <b>minimum sampling</b> for a <b>band pass signal</b> limited from 50 – 75 MHz.	5	CO1
Q 2	Draw the structure of <b>E1</b> line. If <b>5 E1</b> lines are <b>multiplexed</b> and in between each line <b>10 synchronization bits</b> are used, then find the minimum <b>bandwidth</b> required to transmit it.	5	CO2
Q 3	Why <b>polar line coding</b> and <b>coherent</b> detection is used in <b>BPSK</b> , whereas <b>unipolar line coding</b> and <b>non-coherent</b> detection is used in <b>ASK</b> ?	5	CO4
Q 4	Calculate the <b>bandwidth</b> required to transmit a signal using <b>FSK</b> technique. The input data rate is <b>160 kbps</b> and carrier frequency is <b>50 kHz</b> . Draw the <b>spectrum</b> too.	5	CO3

**SECTION B**

Q 5	Under what categories AMI line coding lacks behind Manchester line coding. Draw <b>AMI</b> , <b>Manchester</b> , <b>B6ZS</b> and <b>HDB3</b> line coding for the input bit sequence <b>110000001000001</b> with proper bit timing.	10	CO4
Q 6	Write down the condition of <b>error probability</b> for <b>both binary</b> sequences.  Find the <b>probability of error</b> of <b>binary phase shift keying modulation</b> scheme using white noise and matched filter analysis.	10	CO3

Q 7	<p>Draw the <b>block diagram</b> of a <b>MODEM</b> using <b>Binary Phase Shift Keying</b> modulation scheme. If the rate of incoming bit is 20 kbps and the frequency of the carrier signal, fed to the modulator, is 900 kHz, then find the frequency at each path of the MODEM.</p> <p style="text-align: center;"><b>or</b></p> <p>Draw the <b>block diagram</b> of a <b>MODEM</b> using <b>Binary Frequency Shift Keying</b> modulation scheme. If the rate of incoming bit is 20 kbps and the frequency of the carrier signal, fed to the modulator, is 900 kHz, then find the frequency at each path of the MODEM.</p>	<b>10</b>	<b>CO3</b>
Q 8	<p>A signal is given as: <math>m(t) = \cos 62800t + \cos 314 \times 10^3 t</math>. It is ideally <b>sampled</b> and <b>quantized</b> using 512 level of quantization. The signal is transmitted using QPSK scheme, with the carrier frequency of 1.0 GHz. Determine the <b>minimum bandwidth</b> required to transmit the <b>spectrum</b> for <b>first null point</b> and <b>second null point</b>.</p>	<b>10</b>	<b>CO2</b>
<b>SECTION-C</b>			
Q 9	<p>A student designed a DPSK modulator and demodulator separately for the transmission and reception of a sequence of bits over a small distance in laboratory. The modulator was perfect without any error and shows a noise free waveform at its output display unit. The received signal at the demodulator also shows a good result on the eye diagram display unit and waveform display unit, but the received bits are not in sequence with the transmitting bits. What went wrong with the demodulation?</p>	<b>10</b>	<b>CO3</b>
Q 10	<p>Encode the following using <b>Huffman Coding</b> technique.</p> <p>[M] = M<sub>1</sub>    M<sub>2</sub>    M<sub>3</sub>    M<sub>4</sub>    M<sub>5</sub>    M<sub>6</sub>    M<sub>7</sub>    M<sub>8</sub>    M<sub>9</sub>    M<sub>10</sub></p> <p>[P] = 0.20    0.10    0.12    0.05    0.07    0.15    0.05    0.03    0.14    0.09</p>	<b>10</b>	<b>CO2</b>
Q 11	<p>An engineer <b>designed</b> a <b>digital link</b> between two stations. The stations are 1500 km apart and there is direct line of communication radio link between the two stations. The maximum allowable bandwidth supported by the link is 40 kHz. The engineer recorded a speech signal for 5 minutes. The maximum allowable frequency of this speech signal was limited to 10 kHz. It was converted into streams of 0s and 1s using PCM technique. The number of bits required to encode one sampled signal is 6. The PCM signal is fed into a modulator operating at 750 MHz of carrier frequency. Which type of digital modulation scheme the engineer has to choose for an uninterrupted transmission? Also determine the range of frequencies over the wireless link in which the transmission happens.</p>	<b>20</b>	<b>CO4</b>