Tutorial 2:

1. What are the layers of the OSI model?

2. In the OSI model, which layer determines path selection in a network?

3. What types of things are defined at the physical layer?

4. The following diagram illustrates the TCP/IP encapsulation.
   a) Explain briefly what encapsulation means.
   b) Which layer is the highest, layer 1 or layer 4?
   c) Sketch the direction of layer flow in the transmitting device.
   d) Determine the four layers used in the TCP/IP protocol.
   e) What can you find in Ethernet trailer?

5. Open protocol is very important in the field of automation and control. Why?

6. For sending a seven-bit ASCII character, a simple protocol adds a parity bit, a start bit, and two stop bits. Compute the overhead of this protocol.

7. A user of a stand-alone personal computer wishes to transfer a 30Kbyte file onto another stand-alone personal computer in a nearby building. She copies the file onto a floppy disk, walks to the other building and copies the file onto the other computer. If it takes her five minutes to walk from one computer to the other, what is the effective data rate of the "communication channel" created by her journey?
   [Note: 1K = 1024]

8. The following table summarizes the two different physical layer characteristics used in FOUNDATION Fieldbus:

	H1	HSE
Data Rate	31.25kbps	10 or 100Mbps
Topology	Bus	Star
Bus Power	Yes	No
Number of devices	2-32	NA
Cable length	1900m	100m

   a) What type of Fieldbus uses less wire? Why?
   b) Sketch the network topologies of H1 and HSE.

Solution Guide:

1. Application, presentation, session, transport, network, data link, physical.

2. Layer 3, the network layer.

3. Voltage levels, time of voltage changes, physical data rates, maximum transmission distances, physical connectors, and type of media.

4. a) Each protocol layer adds a header to the data it receives from the layer above it. This is called *encapsulation*.
   b) Layer 1
   c) Layer 1 -> Layer 2 -> Layer 3 -> Layer 4 -> Physical Layer
   d) 1-Application, 2-Transport, 3-Network, 4-Data Link
   e) Error checking code like CRC

5. Ensure interoperability and connectivity.

6. $4 / (4+7) = 36\%$

7. Data rate $= 30 (1024) (8) / 5(60) = 819.2$ bps

8. a) H1 topology uses less wire because (1) it uses bus topology and (2) the power is provided in the bus trunk.
   b)   H1   HSE