



MODEL ANSWER

WINTER– 18 EXAMINATION

Subject Title: Instrumentation Data Communication

Subject Code:

22336

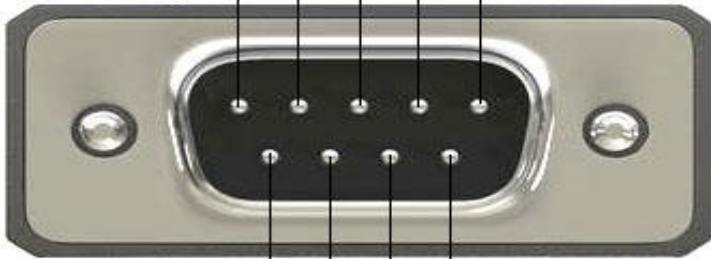
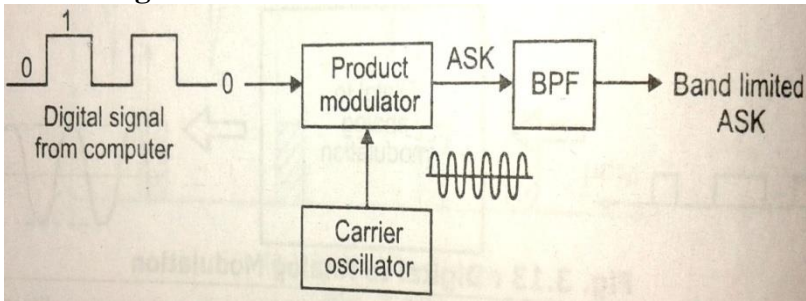
Important Instructions to examiners:

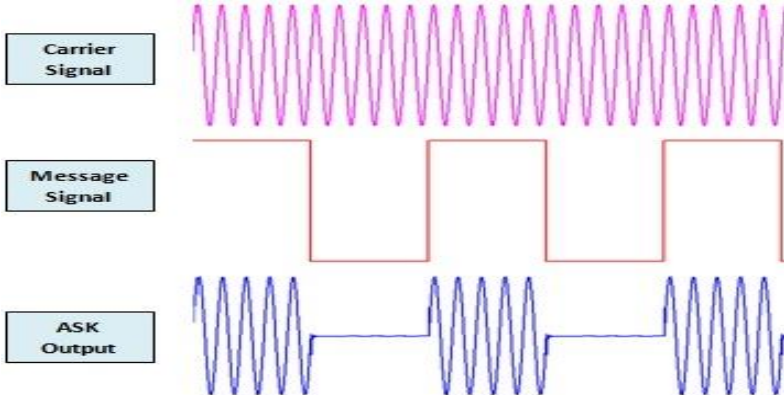
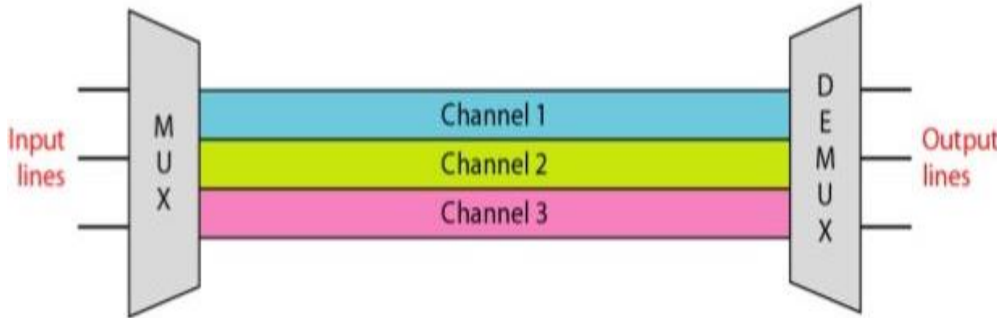
- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

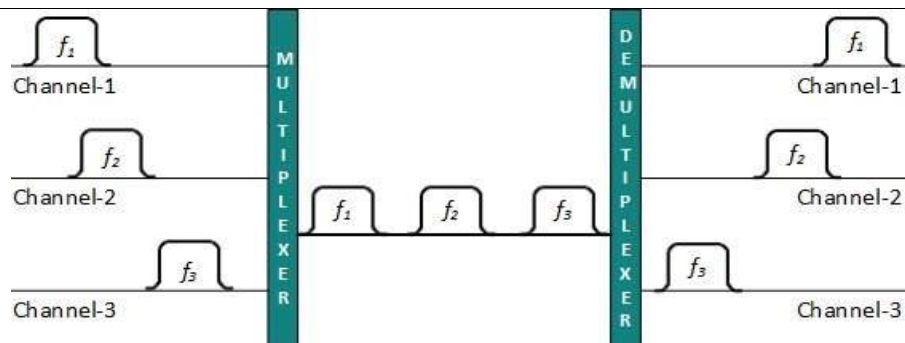
Q. No.	Sub Q.N.	Answer	Marking Scheme
Q.1		Attempt any five of the following	10-Total Marks
	a)	Define the terms: i. Signal to noise ratio ii. Bitrate.	2M
	Ans:	Signal-to-Noise Ratio (SNR):- <ul style="list-style-type: none">It is the ratio of the signal power to the noise power.The higher the value of SNR, the greater will be the quality of the received output. Bit Rate:- <ul style="list-style-type: none">The number of bits per second that can be transmitted along a digital network.Bit Rate= Baud Rate* Number of bits per signal element.	1M 1M
	b)	State the need for multiplexing.	2M
	Ans:	<ul style="list-style-type: none">Multiplexing is the set of techniques that allows the simultaneous transmission of multiple signals across a signals data link.Sending many signals separately is expensive and requires more wires to send. So there is a need of multiplexing.The multiplexing divides the capacity of the low-level communication channel into several higher-level logical channels, one for each message	1M for each need



	signal or data stream to be transferred. <ul style="list-style-type: none">• Multiplexing also simplifies the drive electronics, reduces the cost.	
c)	Classify computer networks based on transmission technologies.	2M
Ans:	Classification of computer networks based on transmission technologies. <ol style="list-style-type: none">1. Point to-point2. Broadcast based	1M each
d)	State the function of hub and repeater	2M
Ans.	Hubs: <ul style="list-style-type: none">• A hub is a common connection point for devices in a network. Hubs connect segments of a LAN.• It contains multiple ports so when a packet arrives at one port, it is copied to the other ports so that all segments of the LAN can see all packets.• A hub interconnects two or more workstations into a local area network.• When a workstation transmits data frame to a hub, the hub immediately resends the data frame to all connecting links. Repeater: <ul style="list-style-type: none">• The major function is to receive a network signal from one LAN terminal cable segment and to regenerate and retransmit the signal as it is in its original strength over a one or more other cable segment.• Basically repeater regenerates the strength of the signal before transmitting it.• They allow a cabling system to extend beyond its maximum allowed length by amplifying the network voltages so they travel farther.	1M for each function 1M for each function
e)	State two specifications of MODBUS	2M
Ans.	Specifications of MODBUS (any two) <ol style="list-style-type: none">1. It supports transmission speed between 9.6kbps to 19.2 kbps2. It supports master slave communication method3. It allows communication between approximately 247 devices when connected to same network without repeaters4. The bus can communicate over a maximum distance of 1300 meters and can expanded using routes and switches	1M each
f)	State two advantages of client	2M
Ans.	Advantages of client server network (any two) <ol style="list-style-type: none">1. Centralized back up is possible.2. Use of dedicated server improves the performance of whole system.3. Security is better in these networks as all the shared resources are centrally administered.4. Use of dedicated servers also increases the speed of sharing resources.5. Up gradation and Scalability can be made easily by just upgrading the server. Also new resources and systems can be added by making necessary changes in server. (Note - If students attempted to solve consider and give appropriate marks)	1M each advantage

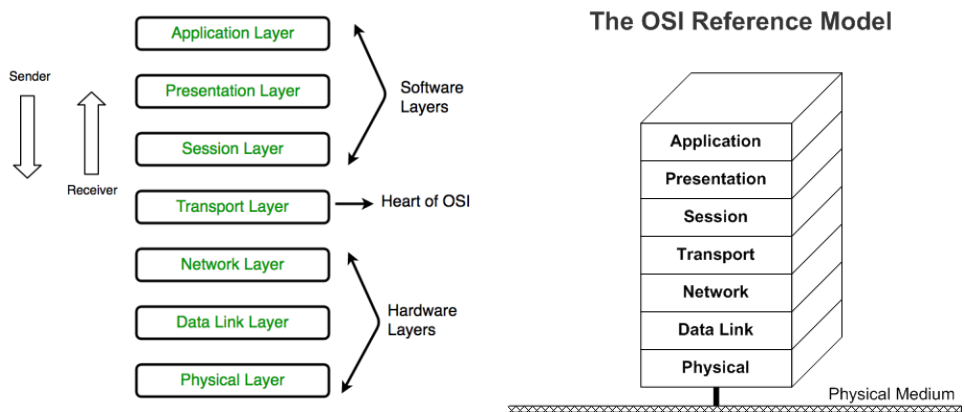
	g)	Draw the 9 pinout of RS 232 Communication	2M
	Ans.	<p style="text-align: center;"><u>RS232 Pinout</u></p> <div style="text-align: center;"> <p>Pin 1: Data Carrier Detect (DCD) Pin 2: Received Data (RXD) Pin 3: Transmit Data (TXD) Pin 4: Data Terminal Ready (DTR) Pin 5: Ground (GND)</p>  <p>Pin 6: Data Set Ready (DSR) Pin 7: Request To Send (RTS) Pin 8: Clear To Send (CTS) Pin 9: Ring Indicator (RI)</p> </div>	2M
Q 2		Answer any three of the following:	12-Total Marks
	a)	State the need for modulation	4M
	Ans:	<p>The baseband transmission is a low frequency transmission. And it cannot transmit for long distance. So to overcome this limitation, modulation is required.</p> <p>Modulation is necessary in communication system because of the following reasons</p> <ol style="list-style-type: none"> 1. Reduction in the height of antenna 2. Avoids mixing of signals 3. Increases the range of communication 4. Multiplexing is possible 5. Improves quality of reception 	01 M for each need
	b)	With the help of waveforms, explain the working of amplitude shift keying	4M
	Ans:	<p>Block Diagram:-</p> 	1M

	<p>Explanation:- Carrier Oscillator</p> <ul style="list-style-type: none"> It generates sinewave with frequency f_c. <p>Product Modulator</p> <ul style="list-style-type: none"> It multiplies the modulating signal and carrier signal. Due to multiplication, the ASK output will be present only when a binary '1' is to be transmitted. And output will be zero when a binary '0' is to be transmitted as shown in the waveform <p>Band Pass Filter (BPF)</p> <ul style="list-style-type: none"> It allows only wanted frequency, rejecting unwanted frequency. <p>Waveforms:-</p> 	<p>1M</p> <p>2M</p>
c)	Explain the principle of working of FDM	4M
Ans:	<p>Explanation:-</p> <ul style="list-style-type: none"> FDM is an analog technology. FDM divides the spectrum or carrier bandwidth in logical channels and allocates one user to each channel. Each user can use the channel frequency independently and has exclusive access of it. All channels are divided in such a way that they do not overlap with each other. Channels are separated by guard bands. Guard band is a frequency which is not used by either channel. <p>Diagram:-</p>  <p style="text-align: center;">OR</p>	<p>2M</p> <p>2M</p>



d)	<p>The diagram given below fig 1. I Illustrates simple network architecture. It represents a layered model of a communication system used for transferring of files between computers over a network.</p> <table border="1"><tr><td>File Transfer Layer</td></tr><tr><td>Transport Layer</td></tr><tr><td>Network Access Layer</td></tr></table> <p>Fig 1</p> <p>i. State the major function of Network Access Layer</p> <p>ii. State the tasks performed by transport layer</p>	File Transfer Layer	Transport Layer	Network Access Layer	4M
File Transfer Layer					
Transport Layer					
Network Access Layer					
Ans:	<p>i. Function of Network Access Layer</p> <ul style="list-style-type: none">• The Network Access Layer is the lowest layer of the TCP/IP protocol hierarchy.• The protocols in this layer provide the means for the system to deliver data to the other devices on a directly attached network.• It defines how to use the network to transmit an IP datagram.• Network Access Layer defines details of how data is physically sent through the network, including how bits are electrically or optically signaled by hardware devices that interface directly with a network medium, such as coaxial cable, optical fiber, or twisted pair copper wire. <p>ii. Tasks performed by transport layer</p> <ul style="list-style-type: none">• The purpose of Transport layer is to permit devices on the source and destination hosts to carry on a conversation.• Transport layer defines the level of service and status of the connection used when transporting data.• It is responsible for process to process delivery of message.• Whenever data is transferred across different network, it treats each packet individual so it keeps the whole packet intact and keeps the message in same order.• It ensures error and flow control ie it check error in message and synchronize speed of sender and receiver.• Service point addressing: - it deals with process to process delivery for that it needs port address, so that the message reaches correct port no.• Segmentation and re-assembly: - in this message is transmitted in form of segments with sequence number that enables reassembling at the receiver side.• It can have connection less and connection oriented transmission.	<p>2M any two function</p> <p>2M any two task</p>			

Q. 3	Attempt any three of the following:	12-Total Marks
a)	Encode the data stream 1011001010 using unipolar RZ and Polar RZ encoding techniques.	4M
Ans:	<p>The diagram shows the encoding of the data stream 1011001010. The top row shows the data stream. The second row shows the unipolar RZ encoding, where the signal is high for '1' and low for '0', with the signal level dropping to half during the RZ period. The third row shows the Polar RZ encoding, where the signal is high for '1' and low for '0', with the signal level dropping to half during the RZ period. The diagram also includes labels for '1 bit interval' and 'half bit interval'.</p>	Data stream w/f 1M & encoding 1 ½ M each
b)	Describe the construction of a fiber optic cable with labeled sketch	4M
Ans:	<p>The sketch shows the construction of a single fiber optic cable. The outer jacket is labeled 'OUTER JACKET'. The strength members are labeled 'STRENGTH MEMBER'. The buffer jacket is labeled 'BUFFER JACKET'. The silicone coating is labeled 'SILICONE COATING'. The cladding (silica) is labeled 'CLADDING (silica)'. The core (silica) is labeled 'CORE (silica)'. The optical fiber is labeled 'OPTICAL FIBER'. The inner coating is labeled 'INNER COATING'. The fiber is labeled 'FIBER'.</p> <ul style="list-style-type: none"> Fiber optic cable consists of a core, cladding, coating, buffer strengthening fibers, and cable jacket. The core is the physical medium that transports optical data signals from an attached light source to a receiving device. It is a single continuous strand of glass or plastic that's measured (in microns) by the size of its outer diameter. The cladding is a thin layer that surrounds the fiber core and serves as a boundary that contains the light waves and causes the refraction, enabling data to travel throughout the length of the fiber segment. The coating is a layer of plastic that surrounds the core and cladding to reinforce the fiber core, help absorb shocks, and provide extra protection against excessive cable bends. These coatings are measured in microns (μ); 	2M

	<p>the coating is 250μ and the buffer is 900μ.</p> <ul style="list-style-type: none"> Strengthening fibers help protect the core against crushing forces and excessive tension during installation. This material is generally Kevlar® yarn strands within the cable jacket. The cable jacket is the outer layer of any cable. Most fiber optic cables have an orange jacket, although some types can have black, yellow, aqua or other color jackets. Various colors can be used to designate different applications within a network. 	
c)	Draw the seven layered architecture of OSI reference model. State the functions of network layer and session layer	4M
Ans:	<p>OSI Reference Model:</p>  <p>OSI stands for Open Systems Interconnection. It has been developed by ISO – ‘International Organization of Standardization’, in the year 1974. It is 7 layer architecture, with each layer having specific functionality to perform. All these 7 layers work collaboratively to transmit the data from one person to another across the globe.</p> <p>Functions of Network layer:- Network layer works for the transmission of data from one host to the other located in different networks. It also takes care of packet routing i.e. selection of shortest path to transmit the packet, from the number of routes available. The sender & receiver’s IP address are placed in the header by network layer. The functions of the Network layer are :</p> <ol style="list-style-type: none"> Routing: The network layer protocols determine which route is suitable from source to destination. This function of network layer is known as routing. Logical Addressing: In order to identify each device on internetwork uniquely, network layer defines an addressing scheme. The sender & receiver’s IP address are placed in the header by network layer. Such an address distinguishes each device uniquely and universally. <p>Functions of Session layer:- This layer is responsible for establishment of connection, maintenance of sessions, authentication and also ensures security. The functions of the session layer are :</p> <ol style="list-style-type: none"> Session establishment, maintenance and termination: The layer allows the two processes to establish, use and terminate a connection. Synchronization: This layer allows a process to add checkpoints which are 	<p>Diagram 2M (Explanati on is optional)</p> <p>Function 1M each</p> <p>Function 1M each</p>

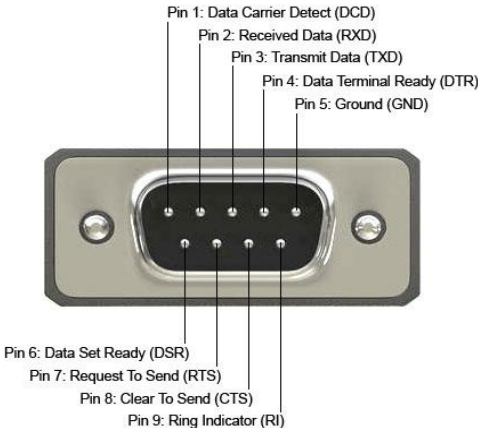
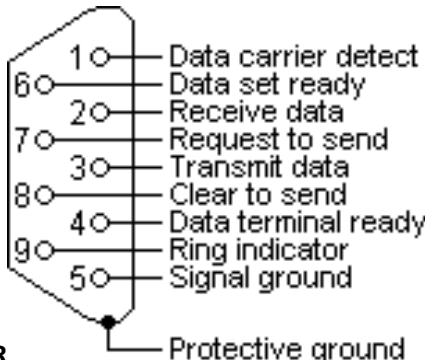


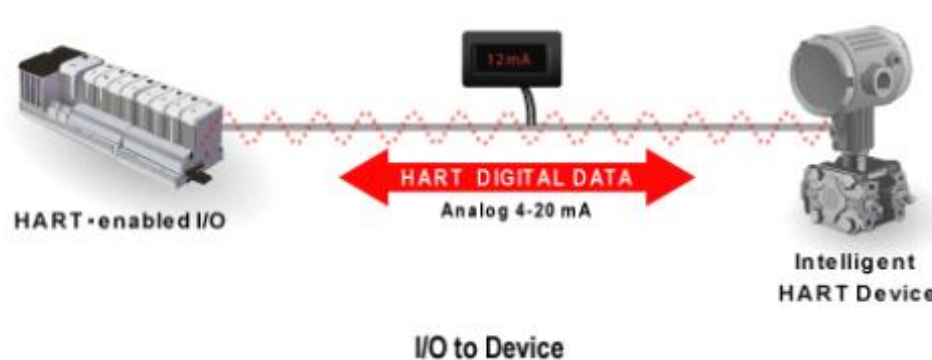
		considered as synchronization points into the data. These synchronization point help to identify the error so that the data is re-synchronized properly, and ends of the messages are not cut prematurely and data loss is avoided. 3. Dialog Controller: The session layer determines which device will communicate first and the amount of data that will be sent																
	d)	Compare WAN and LAN on the basis of i. Area covered ii. Propagation delay iii. Speed iv. Congestion	4M															
	Ans:	<table><tr><th>Parameters</th><th>WAN</th><th>LAN</th></tr><tr><td>Area covered</td><td>Large geographic areas (e.g., cities, states, nations)</td><td>Local areas only (e.g., homes, offices, schools)</td></tr><tr><td>Propagation delay</td><td>Long</td><td>Short</td></tr><tr><td>Speed</td><td>WANs have a lower data transfer rate compared to LANs. Less speed (150 Mbps)</td><td>LANs have a high data transfer rate. High speed (1000 mbps)</td></tr><tr><td>Congestion</td><td>More congestion</td><td>Less congestion</td></tr></table>	Parameters	WAN	LAN	Area covered	Large geographic areas (e.g., cities, states, nations)	Local areas only (e.g., homes, offices, schools)	Propagation delay	Long	Short	Speed	WANs have a lower data transfer rate compared to LANs. Less speed (150 Mbps)	LANs have a high data transfer rate. High speed (1000 mbps)	Congestion	More congestion	Less congestion	1M each
Parameters	WAN	LAN																
Area covered	Large geographic areas (e.g., cities, states, nations)	Local areas only (e.g., homes, offices, schools)																
Propagation delay	Long	Short																
Speed	WANs have a lower data transfer rate compared to LANs. Less speed (150 Mbps)	LANs have a high data transfer rate. High speed (1000 mbps)																
Congestion	More congestion	Less congestion																
Q. 4		Attempt any three of the following :	12-Total Marks															
	a)	With a sketch, describe the working of p-i-n photo diode	4M															

[illegible]



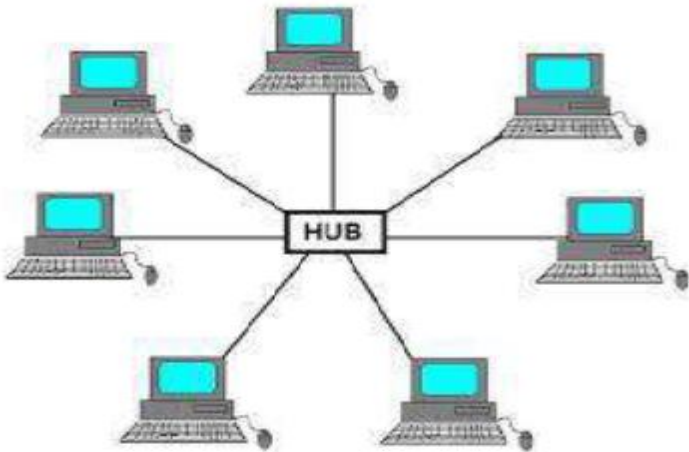
Ans:	<div data-bbox="289 184 1024 651"><p>Layer 7: Application FMS / DP-V0 / DP-V1 / DP-V2</p><p>Layer 6: Presentation</p><p>Layer 5: Session</p><p>Layer 4: Transport</p><p>Layer 3: Network</p><p>Layer 2: Data Link FDL</p><p>Layer 1: Physical RS485 / Fiber-Optic / MBP</p></div> <p>Description:-</p> <ul style="list-style-type: none">• PROFIBUS networks make use of three separate layers of the OSI Network model.• First, PROFIBUS describes the application layer. There are multiple versions of PROFIBUS that handle different types of messaging at the application layer.• Some of the types of messaging PROFIBUS supports include cyclic and acyclic data exchange, diagnosis, alarm-handling, and isochronous messaging.• PROFIBUS does not define layers three through six. It does, however, define the data link and physical layers, layers one and two.• The data link layer is completed through a Field bus Data Link, or FDL. The FDL system combines two common schemes, master-slave methodology and token passing. In a master-slave network, masters, usually controllers, send requests to slaves, sensors and actuators. The slaves respond accordingly.• PROFIBUS also includes token passing, a system in which a “token” signal is passed between nodes. Only the node with the token can communicate.• The token passing concept is like the speaking conch; only the person with the conch is allowed to talk.• Finally, PROFIBUS defines a physical layer, though it leaves room for flexibility. PROFIBUS systems can have three types of media. E.g. Standard twisted-pair wiring system (RS485), fiber-optic transmission.• PROFIBUS uses the bus topology.• PROFIBUS FMS The initial version of PROFIBUS was PROFIBUS FMS, Field bus Message Specification. PROFIBUS FMS was designed to communicate between Programmable Controllers and PCs, sending complex information between them. This protocol was not appropriate for less complex messages or communication on a wider, more complicated network.• PROFIBUS DP The second type of PROFIBUS is more universal. Called PROFIBUS DP, for Decentralized Periphery, this new protocol is much simpler and faster. PROFIBUS DP has, itself, three separate versions. Each version, from DP-V0 to DP-V1 and DP-V2, provides newer, more complicated	<p>2M</p> <p>2M</p>
-------------	---	---------------------

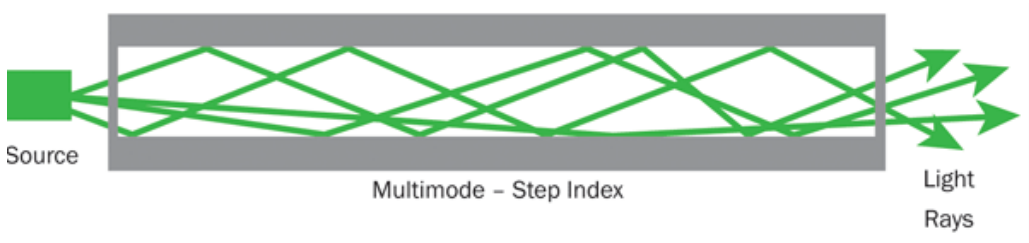

	<p>features.</p> <ul style="list-style-type: none"> • PROFIBUS PA PROFIBUS PA is a protocol designed for Process Automation. In actuality, PROFIBUS PA is a type of PROFIBUS DP Application profile. PROFIBUS PA standardizes the process of transmitting measured data. • MBP Technology Manchester Bus Powered technology (MBP) can be used with PROFIBUS PA. It permits transmission of both data and power. 	
c)	State the functions of the pins in RS232 communication interface standard	4M
Ans:	<p style="text-align: center;"><u>RS232 Pinout</u></p>   <p style="text-align: center;">OR</p> <p>Functions of the pins in RS-232:-</p> <ul style="list-style-type: none"> • Pin1 is a data carrier detect it is receiving a carrier from a remote DCE. • Pin2 is a receive data pin, which is used to Carries data from DCE to DTE. • Pin3 is a transmit data pin, which is used to Carries data from DTE to DCE. • Pin4 is a data terminal ready pin, DTE is ready to receive, initiate, or continue a call. • Pin5 is signal ground pin. • Pin6 is data set ready pin, DCE is ready to receive and send data. • Pin7 is the request to send pin, DTE requests the DCE prepare to transmit data. • Pin8 is clear to send pin, DCE is ready to accept data from the DTE • Pin9 is ring indicator; DCE has detected an incoming ring signal on the telephone line. 	½ M for each function
d)	Describe with broad specifications the software and hardware requirement to setup HART system	4M
Ans:	<ul style="list-style-type: none"> • HART™ is an acronym for Highway Addressable Remote Transducer. HART is a bi- directional communication protocol that provides data access between intelligent field instruments and host systems. • Digital device information is communicated by encoding a digital signal, generally using a technique known as Frequency Shift Keying on the same 4-20mA wiring used for analog communications. • The HART Protocol makes uses Frequency Shift Keying (FSK) standard to superimpose digital communication signals at a low level on top of the 4- 	4M

		<p>20mA. This enables two-way field communication to take place and makes it possible for additional information beyond just the normal process variable to be communicated to/from a smart field instrument.</p> <ul style="list-style-type: none"> The HART Protocol communicates at 1200 bps without interrupting the 4-20mA signal and allows a host application (master) to get two or more digital updates per second from a smart field device. As the digital FSK signal is phase continuous, there is no interference with the 4-20mA signal.  <p style="text-align: right;">T</p>	
e)	<p>State one application and one limitation of the following types of transmission media</p> <ol style="list-style-type: none"> Coaxial cable Optical fibre Twisted pair lines Wireless media 	4M	
Ans:	<p>Application of Coaxial cable:-</p> <ul style="list-style-type: none"> Coaxial cable is also widely used in local area networks (LANs). Micro coaxial cables are used in a range of consumer devices, military equipment, and also in ultra-sound scanning equipment. It is used by consumers to connect television receivers to external antennas. Short coaxial cables are also employed to connect home video equipment and radio systems. Long distance coaxial cable was used to connect radio networks and television networks. <p>Limitation of Coaxial cable:-</p> <ul style="list-style-type: none"> It is also has high attenuation, have the need to implement repeaters. More expensive than twisted pairs and is not supported for some network standards. A continuous current flow, even if small, along the imperfect shield of a coaxial cable can cause visible and audible interference. Signals entering the cables can cause unwanted noise and picture ghosting, making it useless. <p>Application of optical fibre:-</p> <ul style="list-style-type: none"> Medical Used as light guides, imaging tools and also as lasers for surgeries. Defense/Government 	<p>Any one application ½ M</p> <p>Any one limitation ½ M</p> <p>Any one application ½ M</p>	



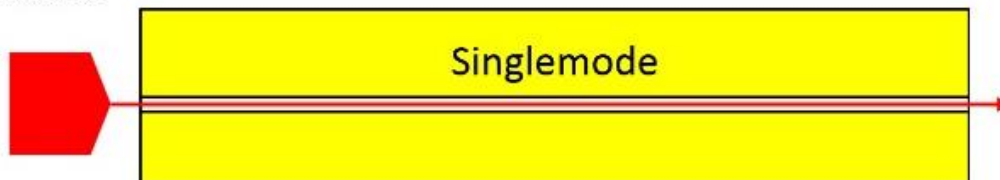
	<p>Used as hydrophones for seismic waves and SONAR , as wiring in aircraft, submarines and other vehicles and also for field networking.</p> <ul style="list-style-type: none">• Data Storage Used for data transmission.• Telecommunications Fiber is laid and used for transmitting and receiving purposes.• Networking Used to connect users and servers in a variety of network settings and help increase the speed and accuracy of data transmission• Industrial/Commercial Used for imaging in hard to reach areas, as wiring where EMI is an issue, as sensory devices to make temperature, pressure and other measurements, and as wiring in automobiles and in industrial settings.• Broadcast/CATV Broadcast/cable companies are using fiber optic cables for wiring CATV, HDTV, internet, video on-demand and other applications. <p>Limitation of optical fibre:-</p> <ul style="list-style-type: none">• Difficult to Splice: - The optical fibers are difficult to splice, and there are loss of the light in the fiber due to scattering.• Expensive to install: - The optical fibers are more expensive to install, and they have to be installed by the specialists.• Highly Susceptible: - The fiber optic cable is a small and compact cable, and it is highly susceptible to becoming cut or damaged during installation or construction activities. <p>Application of Twisted pair lines:-</p> <ul style="list-style-type: none">• In telephone lines• In DSL lines• In LAN <p>Limitation of Twisted pair lines:-</p> <ul style="list-style-type: none">• STP wire is that it is physically larger and more expensive than twisted pair wire.• STP is more difficult to connect to a terminating block. <p>Application of Wireless media:-</p> <ul style="list-style-type: none">• Security systems• Television remote control• Wi-Fi, Cell phones,• wireless power transfer• Computer interface devices <p>Limitation of Wireless media:-</p> <ul style="list-style-type: none">• An unauthorized person can easily capture the wireless signals which spread through the air.• It is very important to secure the wireless network so that the information cannot be misused by unauthorized user.	<p>Any one limitation $\frac{1}{2}$ M</p> <p>Any one application $\frac{1}{2}$ M</p> <p>Any one limitation $\frac{1}{2}$ M</p> <p>Any one application $\frac{1}{2}$ M</p> <p>Any one limitation $\frac{1}{2}$ M</p>
Q.5	Attempt any two of the following	Total

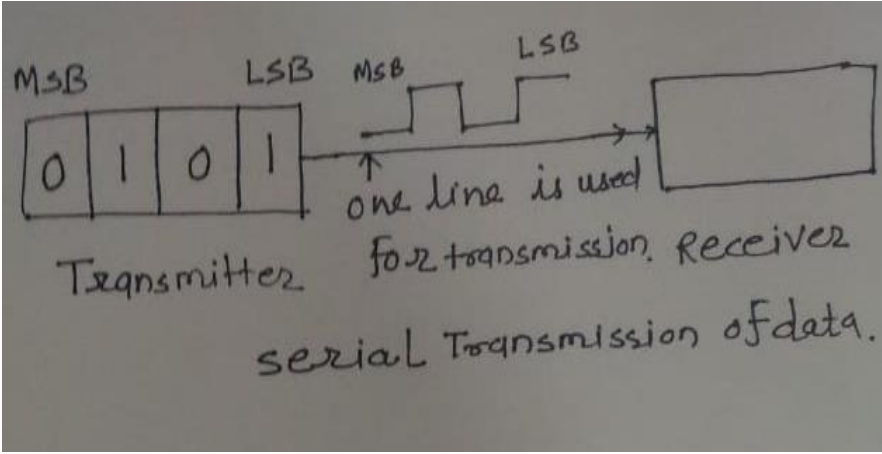
			Marks 12
	a)	<p>I. State the bandwidth requirement for the following</p> <ol style="list-style-type: none"> ASK FSK BPSK QPSK <p>II. Define Bandwidth with reference to analog signal and digital signal</p>	6M
	Ans:	<p>I. Bandwidth requirement for the following</p> <ol style="list-style-type: none"> ASK = $2f_b$ FSK = $4f_b$ BPSK = $2f_b$ QPSK = f_b <p>II. Bandwidth with reference to analog signal- It is defined as the range of frequencies being passed by the medium.</p> <p>Bandwidth with reference to digital signal – It is defined as the maximum bit rate that a medium is able to pass.</p>	<p>1 mark for each bandwidth</p> <p>& 1 mark for each definition</p>
	b)	With a sketch, describe star topology. State one advantage, one disadvantage and one application.	6M
	Ans:	<div style="text-align: center;">  </div> <p>Star Topology:</p> <ul style="list-style-type: none"> In this topology, nodes are connected to central cable; here all the hosts or workstations are connected to central device called hub. All the data on the star topology passes through the central device before reaching the intended destination. <p>Advantages:</p> <ul style="list-style-type: none"> A single computer failure does not affect the entire network. Easy to expand – Adding new node in Network is easy. Centralized control-It enhance N/w monitoring & management. Fault detection is easy because all nodes are connected to central HUB. <p>Disadvantages :</p> <ul style="list-style-type: none"> If the hub fails, entire system collapses. 	<p>2 M for sketch</p> <p>1 M for description,</p> <p>1M for any one advantage</p> <p>1 M for</p>

	<ul style="list-style-type: none"> • Cabling cost is more. • Moderately difficult to install. <p>Applications :</p> <ul style="list-style-type: none"> • Star topology is a networking setup used with 10BASE-T cabling. • Star Topology is the most common type of network topology that is used in homes and offices. • Star topology is used to ease the probabilities of network failure by connecting all of the systems to a central node. • Star network is used to transmit data across the central hub between the network nodes. 	<p>any one disadvantage</p> <p>1 M for any one application</p>
c)	Explain the different modes of propagation of light in fiber optic cable	6M
Ans:	<p>Different modes of propagation of light in fiber optic cable are as follows :</p> <p>1. STEP-INDEX MULTIMODE FIBER: has a large core, up to 100 microns in diameter. As a result, some of the light rays that make up the digital pulse may travel a direct route, whereas others zigzag as they bounce off the cladding. These alternative pathways cause the different groupings of light rays, referred to as modes, to arrive separately at a receiving point. The pulse, an aggregate of different modes, begins to spread out, losing its well-defined shape. The need to leave spacing between pulses to prevent overlapping limits bandwidth that is, the amount of information that can be sent .Consequently, this type of fiber is best suited for transmission over short distances, in an endoscope, for instance.</p>  <p style="text-align: center;">Multimode – Step Index</p> <p>2. GRADED-INDEX MULTIMODE FIBER contains a core in which the refractive index diminishes gradually from the center axis out toward the cladding. The higher refractive index at the center makes the light rays moving down the axis advance more slowly than those near the cladding. Also, rather than zigzagging off the cladding, light in the core curves helically because of the graded index, reducing its travel distance. The shortened path and the higher speed allow light at the periphery to arrive at a receiver at about the same time as the slow but straight rays in the core axis. The result: a digital pulse suffers less dispersion.</p>  <p style="text-align: center;">Multimode – Graded Index</p>	<p>Each mode 2 marks (1 mark for sketch & 1 mark for description)</p>

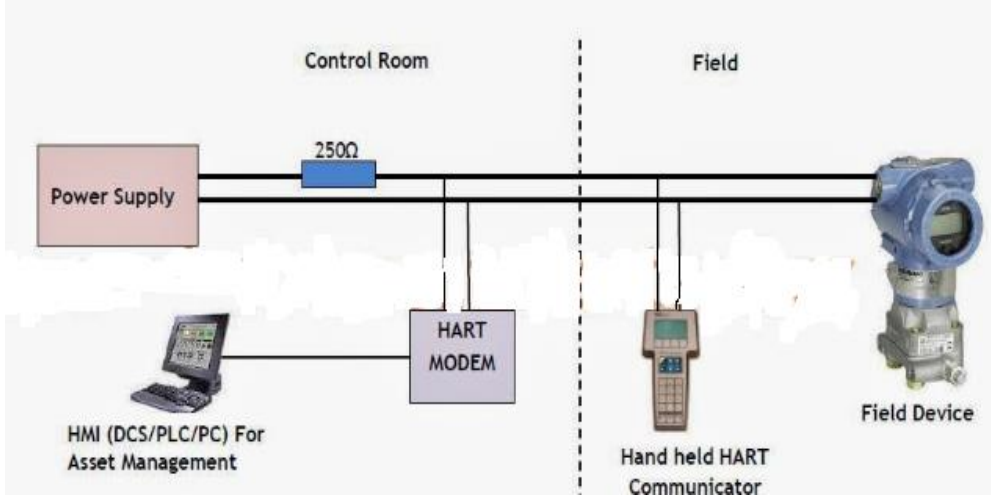
- 3. SINGLE-MODE FIBER** has a narrow core (eight microns or less), and the index of refraction between the core and the cladding changes less than it does for multimode fibers. Light thus travels parallel to the axis, creating little pulse dispersion. Telephone and cable television networks install millions of kilometers of this fiber every year

Source



Q.6	Attempt any two of the following	Total Marks 12
a)	Describe serial and Parallel transmission of data with sketch for transmitting a data 0101. State the limitations of each transmission system	6M
Ans:	<p>Serial transmission:</p> <ul style="list-style-type: none"> In serial communication a word of eight bits in length is sent sequentially, and is received after all eight bits are sent, one at a time. The bits are then assembled back into one byte which is the initial communication. A serial communication device sends data in bits, and at the end the bits harmonize to form a byte of data and are thus slower. Serial communication uses fewer connections and cables. The use of fewer wires in serial communication makes its signals clearer, thus making it suitable for long distance communication  <p>Parallel transmission:</p> <ul style="list-style-type: none"> In parallel communication the eight bits are transferred in corresponding 8 channels, every channel transmits a bit, and a byte of data is received simultaneously. Parallel communication is faster because parallel device transmits an 8 	<p>1M</p> <p>1M</p> <p>1M</p>

	<p>bits data within the same time a serial device transmits a single bit.</p> <ul style="list-style-type: none"> Parallel communication uses more wires to allow the transfer of data simultaneously The use of many wires causes the signals to become distorted, making parallel communication unsuitable for long distance transmission. 	1M
	<p>limitations of Serial transmission:</p> <ul style="list-style-type: none"> The speed of data transfer is low. To increase the speed of data transfer, it is necessary to increase the clock frequency. <p>limitations of Parallel transmission :</p> <ul style="list-style-type: none"> Cost of the system is more due to more number of wires are used. Unsuitable for long distance transmission. 	1M any one 1M any one
b)	Develop a Devicenet network for 8 nodes	6M
Ans:	<p>Device net network for 8 nodes</p> <ul style="list-style-type: none"> Devicenet is open communication protocol used in industrial automation to inter connect I/O and control devices. Devicenet uses a trunk line and drop line topology to connect nodes for communication. 	For design-3M & explainat ion-3M

	<ul style="list-style-type: none"> To develop a devicenetnetwork terminating resistor (TR) is used. It is 121Ω resistor that is connected to the end of the trunk line. There are two terminating r resistor per network. Node is an addressable device that communicates on the network. Tap T is a branching point the trunk line. Trunk line is a network cable between terminators it is usually a thick cable. Drop line is the network cable between trunk and node; each drop line may be no longer than 6 meters. Power supply of a 24 V DC source that powers network, there may be multiple power supplies on a network. 	
c)	Describe step-by step procedure to Install/configure HART point-to point communication network	6M
Ans:	<ul style="list-style-type: none"> Point-to-point HART is the connection of a single field device to one or two master devices. In this mode, both the analog (4-20 mA) and the digital signals are transmitted. The standard bus address for point-to-point communication is zero (0), which is also the default address of the field devices. While setting up your system, it is important to verify that the device address is not set to a different value (i.e. 1-15) and that no other device with address 0 is connected <div style="text-align: center;">  <p>HART point-to point communication network :</p> </div> <p>step-by step procedure to Install/configure HART point-to point communication network :</p> <ul style="list-style-type: none"> To power the transmitter, you will need a power supply capable of supplying at least 24VDC and a digital multimeter to measure output current. To enable communication with the HART communicator, a resistance of 250Ω must be connected between the communicator loop connection and the 24VDC power supply. Turn on the communicator by pressing the ON/OFF key. The communicator will search for any HART compatible device in the loop and will indicate when a connection is made. If a connection is 	<p>3M Diagram</p> <p>3M Explanation</p>



		<p>not made, the HART communicator will indicate that no device was found.</p> <ul style="list-style-type: none">• Once the communicator establishes communication with the transmitter, output units can be set, transmitter configured and calibrated appropriately	
--	--	---	--