

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

**CS8601 – Mobile Computing**

**Question Bank**

# **SYLLABUS**

## **CS8601 Mobile Computing**

### **OBJECTIVES:**

The student should be made to:

- Understand the basic concepts of mobile computing
- Be familiar with the network protocol stack
- Learn the basics of mobile telecommunication system
- Be exposed to Ad-Hoc networks
- Gain knowledge about different mobile platforms and application development

### **UNIT I INTRODUCTION**

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA

### **UNIT II MOBILE TELECOMMUNICATION SYSTEM**

Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – Security

### **UNIT III MOBILE NETWORK LAYER**

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks ( VANET) –MANET Vs VANET – Security.

### **UNIT IV MOBILE TRANSPORT AND APPLICATION LAYER**

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

### **UNIT V MOBILE PLATFORMS AND APPLICATIONS**

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

**OUTCOMES:**

- At the end of the course, the student should be able to:
- Explain the basics of mobile telecommunication system
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Use simulator tools and design Ad hoc networks
- Develop a mobile application.

**TEXT BOOK:**

1. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt. Ltd, New Delhi – 2012.

**REFERENCES:**

1. Jochen H. Schller, “Mobile Communications”, Second Edition, Pearson Education, New Delhi
2. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
3. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
4. William.C.Y.Lee, “Mobile Cellular Telecommunications-Analog and Digital Systems”, Second Edition, Tata Mc Graw Hill Edition ,2006.
5. C.K.Toth, “AdHoc Mobile Wireless Networks”, First Edition, Pearson Education, 2002.

## UNIT I

### INTRODUCTION

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA

S. No.	PART-A
1	<p><b>Distinguish Mobile Computing vs. Wireless Networking <u>APR/MAY 2017. NOV/DEC2017. APR/MAY 2018</u></b></p> <p>Mobile computing essentially denotes accessing information and remote computational services while, wireless networking provides the basic communication infrastructure necessary to make this possible. Mobile computing is based on wireless networking and helps one to invoke computing services on remote servers while on the move wireless networking is an important ingredient of mobile computing</p>
2	<p><b>Why “MAC protocol designed for infrastructure based wireless network may not work satisfactory in infrastructure less environment “ – justify? <u>NOV/DEC 2017, APR/MAY 2018</u></b></p> <ul style="list-style-type: none"><li>• Bandwidth Efficiency</li><li>• BW available is very limited<ul style="list-style-type: none"><li>– MAC should be designed such that the scarce bandwidth is utilized in an efficient manner</li></ul></li><li>• Hidden and Exposed Node Problem</li><li>• Collision-prone shared channel<ul style="list-style-type: none"><li>– Multiple nodes may contend for the medium leading to collision</li><li>– MAC should make sure that collision is minimized</li></ul></li><li>• Mobility of Nodes</li><li>• Control information exchanged may become useless due to mobility</li><li>• MAC performance should be satisfactory when nodes are mobile</li><li>• Power consumption</li><li>• QoS support Critical for real time applications</li></ul>
3	<p><b>List the Characteristics of Mobile Computing</b></p> <p>Ubiquity Location awareness Adaptation Broadcast Personalization</p>

4	<p><b>What is Hidden and Exposed Terminal problem? <u>MAY/JUNE 2016</u></b></p> <p><b>Hidden and Exposed Terminals</b></p> <p>Consider the scenario with three mobile phones as shown below. The transmission range of A reaches B, but not C (the detection range does not reach C either). The transmission range of C reaches B, but not A. Finally, the transmission range of B reaches A and C, i.e., A cannot detect C and vice versa.</p> <p><b>Hidden terminals</b></p> <p>A sends to B, C cannot hear A, C wants to send to B, C senses a “free” medium (CS fails) and starts transmitting Collision at B occurs, A cannot detect this collision (CD fails) and continues with its transmission to B A is “hidden” from C and vice versa</p> <p><b>Exposed terminals</b></p> <p>B sends to A, C wants to send to another terminal (not A or B) outside the range C senses the carrier and detects that the carrier is busy. C postpones its transmission until it detects the medium as being idle again but A is outside radio range of C, waiting is <b>not</b> necessary C is “exposed” to B Hidden terminals cause collisions, where as Exposed terminals causes unnecessary delay.</p>
5	<p><b>What are the limitations / challenges of mobile computing? <u>NOV/DEC 2016</u></b> <b><u>NOV/DEC 2018</u></b></p> <p>Quality of connectivity Security concerns Power Consumption</p>
6	<p><b>What are the features / objectives of MAC protocols? <u>NOV/DEC 2018</u></b></p> <p>It should implement some rules that help to enforce discipline when multiple nodes contend for a shared channel.</p> <p>It should help maximize the utilization of the channel.</p> <p>Channel allocation needs to be fair. No node should be discriminated against at any time and made to wait for an unduly long time for transmission.</p> <p>It should be capable of supporting several types of traffic having different maximum and average bit rates.</p> <p>It should be robust in the face of equipment failures and changing network conditions.</p>
7	<p><b>Categories of wireless networks</b></p> <p>Wireless networks can be divided mainly into two categories: (a) infrastructure-based wireless networks that include the WLANs, and (b) infrastructure-less wireless networks that include the mobile ad hoc networks (MANETs).</p>
8	<p><b>What are the different types of mobile Middleware?</b></p> <p>1. Adaptation 2. Agent</p>
9	<p><b>What are the logical channels in GSM?</b></p> <ul style="list-style-type: none"> <li>• Traffic channel (TCH)</li> <li>• Control channel (CCH)</li> </ul>
10	<p><b>What are the disadvantages of small cells?</b></p> <ul style="list-style-type: none"> <li>a) Infrastructure</li> <li>b) Handover</li> <li>c) Frequency</li> </ul>

11	<p><b>What are the characteristics of mobile computing devices?</b></p> <ul style="list-style-type: none"> <li>• Adaptation Data dissemination and Management</li> <li>• Heterogeneity Interoperability Context awareness</li> </ul>
12	<p><b>What are the key constraints of mobile computing?</b></p> <ul style="list-style-type: none"> <li>• unpredictable variation in network quality</li> <li>• lowered trust and robustness of mobile elements</li> </ul>
13	<p><b>What do you mean by Digital Signature?</b></p> <p>Digital signatures are used to enable verification of the records.  A DSA (Digital Structure Algorithm) is used to sign a record before transmitting.  It provides for a variable key length of maximum 512 Or 1024 bits. The DSS(Digital Signature Standard) is based on the DSA.  Signatures enable identification of the sender identify the orgin of the message, and check message integrity</p>
14	<p><b>How is GPRS higher than 2G?</b></p> <p>General Packet Radio Service (GPRS) is an extension of GSM and is considered to be the 2.5 generation technology. it is based on packet switching compared to circuit switching used in 2G. This was a significant improvement over 2G and helped to reduce call costs dramatically. it allows users to remain connected to the Internet without incurring additional charge and supports multimedia capabilities including graphics and video communications.</p>
15	<p><b>How is 3G higher than GPRS?</b></p> <p>The 3G systems support much higher data transmission rates and offer increased bandwidth, which makes them suitable for high-speed data applications as well as for high quality traditional voice calls. The 3G systems can be considered to be purely data networks, since voice signals are converted to digital data</p>
16	<p><b>What are categories of MAC protocols?</b></p> <p>These MAC protocols can be broadly divided into the following three categories:  Fixed assignment schemes  Random assignment schemes  Reservation-based schemes</p>
17	<p><b>What are the categories of fixed assignment MAC</b></p> <p>Frequency Division Multiple Access (FDMA)  Time Division Multiple Access (TDMA)  Code Division Multiple Access (CDMA)</p>
18	<p><b>What is Time Division Multiple Access (TDMA)</b></p> <p>TDMA is an access method in which multiple nodes are allotted different time slots to access the same physical channel. That is, the timeline is divided into fixed-sized time slots and these are divided among multiple nodes who can transmit.</p>
19	<p><b>What is CDMA</b></p> <p>In CDMA, multiple users are allotted different codes that consist of sequences of 0 and 1 to access the same channels. A special coding scheme is used that allows signals from multiple users to be multiplexed over the same physical channel.</p>
20	<p><b>What is the random assignment schemes that are used in MAC protocols. <u>NOV/DEC 2016, APR/MAY 2017</u></b></p> <p>ALOHA  Slotted ALOHA  CSMA  CSMA/CD  CSMA/CA</p>

**PART-B**

1	Explain hidden and exposed terminal problem and near and far terminal problem(Pg no:48) <u>APR/MAY 2017 , NOV/DEC 2017, NOV/DEC2018</u>
2	Explain the various taxonomy of MAC Protocols. Differentiate various schemes. (pg.no 51) <u>MAY/JUNE 2016 , NOV/DEC 2016 APR/MAY 2017.NOV/DEC 2017</u>
3	Explain the distinguishing features of various generations of wireless networks.(Pg-18)_ <u>NOV/DEC 2016</u>
4	Explain MAC Issues (Pg No:48) <u>APR/MAY 2017</u>
5	Explain the structure, characteristics, Applications of mobile computing? (pg-27)_ <u>MAY/JUNE 2016. NOV/DEC2016 , APR/MAY 2017. NOV/DEC 2017. APR/MAY 2018</u>
6	Distinguish wireless LAN and wired LAN. (Pg. 32)
7	Explain the Bluetooth technology (Pg. 16)
8	Apply mobile computing to design taxi dispatcher and monitoring service. Explain the components in detail.( notes) <u>APR/MAY 2018</u>
9	What is CSMA? What are the categories of CSMA? Explain their working with advantage and disadvantage.(Pg. 33) <u>APR/MAY 2018</u>
10	Explain the various schemes of MAC protocol(pg.no 51)
11	List out the applications of Mobile computing? (Pg-29)
12	Explain the issues in wireless MAC(Pg no:48)
13	Expalin about FDMA and TDMA schemes (Pg. 33)
14	Explain the structure of Mobile computing? (Pg. 28)
15	Explain 1G,2G and 3G of wireless network? (Pg. 18)
16	Describe the various random assignment schemes used in MAC protocol <u>NOV/DEC 2018</u>
17	Discuss the various Reservation based schemes in MAC protocol <u>NOV/DEC 2018</u>

## UNIT II

### MOBILE TELECOMMUNICATION SYSTEM

Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – Security

S. No	Question
1	<p><b>why the traditional IP cannot be used in a mobile network. What are the main differences between the traditional IP and the mobile IP? How does mobile IP support mobile hubs?</b></p> <p>IP is responsible for routing a packet to any host, connected to the Internet, uniquely identified by an assigned IP address. The nodes in the LAN are assigned an address based on the LAN address.</p> <p>In the traditional IP addressing scheme, when a host moves to a different location, it may move to another network. As a result, it needs to change its IP address.</p> <p>The mobile IP allows mobile computers to stay connected to the Internet regardless of their location and without changing their IP address.</p> <p>The traditional IP does not support user mobility. Mobile IP was created by extending IP to enable users to keep the same IP address while travelling to a different network.</p>
2	<p><b>List the limitations of IPv4 and how are they overcome by IPv6.</b></p> <p>It would not be able to support the enormous number of users that are expected to use Internet in a couple of years. Also IP does not distinguish among the different applications, and treats all applications equally. A streaming video requires that video frames be transmitted without delay jitters, whereas applications such as e-mail can tolerate considerable delay. This needed the development of a new version of IP called Internet Protocol version 6 (IPv6) and also sometimes referred to as IP Next Generation or IPng.</p>



3.	<p><b>Mention the following terms associated with mobile IP:</b></p> <p><b>Home Network:</b> The home network of a mobile device is the network within which the device receives its identifying IP address (home address). In other words, a home network is a subnet to which a mobile node belongs to as per its assigned IP address. Within the home network, there is no need of mobile IP.</p> <p><b>Home Address (HA):</b> The home address of a mobile device is the IP address assigned to the device within its home network. The IP address on the current network is known as home address.</p> <p><b>Foreign Agent (FA):</b> The foreign agent is a router in a foreign network that functions as the point of attachment for a mobile node when it roams to the foreign network. The packets from the home agent are sent to the foreign node which delivers it to the mobile node.</p> <p><b>Foreign Network:</b> The foreign network is the current subnet to which the mobile node is visiting. It is different from home network. In other words, a foreign network is the network in which a mobile node is operating when away from its home network.</p> <p><b>Correspondent Node (CN):</b> The home agent is a router on the home network serving as the anchor point for communication with the mobile node. It tunnels packets from a device on the Internet, called a correspondent node (CN), to the roaming mobile node.</p> <p><b>Care-of-Address (COA):</b> It is the address that is used to identify the present location of a foreign agent. The packets sent to the MN are delivered to COA.</p> <p>The COA can be any of the following two types:</p> <p>(a) <i>Foreign agent COA:</i> The COA is an IP address of foreign agent (FA).</p> <p>(b) <i>Co-located COA:</i> When the mobile node (MN) acquires a temporary IP address, that address acts as the COA.</p> <p><b>Home Agent (HA):</b> It is located in home network and it provides several services for the MN. HA maintains a location registry. The location registry keeps track of the node locations using the current care-of-address of the MN.</p>
4	<p><b>What do you mean by agent solicitation? Why are agent advertisement messages needed? <u>APR/MAY 2018</u></b></p> <p>In case a mobile node (MN) does not receive any COA, then the MN should send an agent solicitation message. But it is important to monitor that these agent solicitation messages do not flood the network. A mobile node can usually send up to three solicitation messages (one per second) as soon as it enters a new network. The basic purpose of the solicitation messages sent by a mobile node (MN) is to search for a foreign agent (FA).</p>
5	<p><b>Differentiate the functionalities of a foreign agent &amp; Home agent? <u>NOV/DEC2017</u></b></p> <p><b>Home Agent (HA):</b> It is located in home network and it provides several services for the MN. HA maintains a location registry. The location registry keeps track of the node locations using the current care-of-address of the MN.</p> <p><b>Foreign Agent (FA):</b> The foreign agent is a router in a foreign network that functions as the point of attachment for a mobile node when it roams to the foreign network. The packets from the home agent are sent to the foreign node which delivers it to the mobile node.</p>

6	<p><b>What do you mean by encapsulation and decapsulation in the context of mobile IP? Explain why these are needed. <u>MAY/JUNE 2016</u></b></p> <p>Encapsulation refers to arranging a packet header and data in the data part of the new packet. On the other hand, disassembling the data part of an encapsulated packet is called decapsulation. Whenever a packet is sent from a higher protocol layer to a lower protocol layer, the operations of encapsulation and decapsulation usually take place. The packet is encapsulated by a new header that is placed in front of the existing IP header. The encapsulated packet is tunneled to the COA, which act as the new destination address and the HA acts as the source address of the packet. The MN after receiving the packet from CN, forwards a reply packet to the CN by specifying its own IP address along with the address of the CN</p>
7	<p><b>What is tunneling process?</b></p> <p>The packet is forwarded by the home agent to the foreign agent. When the packet comes to the foreign agent (care-of-address), it delivers the packet to the mobile node. This process is called <i>tunneling</i>. Tunneling has two primary functions: encapsulation of the data packet to reach the tunnel endpoint, and decapsulation when the packet is delivered at that endpoint.</p>
8	<p><b>What are the layers of TCP/IP protocol stack?</b></p> <p>The four layers of the protocol are:</p> <ul style="list-style-type: none"> <li>Application layer-messages</li> <li>Transport layer-segments and additional information Internet layer-packets and destination host address</li> <li>Network interface layer-frames and adds checksum</li> </ul>
9	<p><b>What is TCP</b></p> <p><i>(Transmission Control Protocol)</i>: On the sending side, TCP is responsible for breaking a message into small parts, adding sequence numbers and certain other information and after this, making them known as segments. TCP passes the segments to the lower layer protocol for transmission over the network. While at the receiver's end, TCP assembles the segments when they arrive and reconstructs the message.</p> <p><i>IP (Internet Protocol)</i>: At the host machine of an application sending a message, IP is responsible for constructing packets (also called datagrams) from the segments it receives from the transport layer protocol by adding the destination host address and then passes these on to the lower layer protocol for transmitting. On the receiver's side, it deconstructs the segments and then passes these to the transport layer protocol.</p>
10	<p><b>What is DHCP? <u>MAY/JUNE 2016. APR/MAY 2018</u></b></p> <p>The Dynamic Host Configuration Protocol (DHCP) is a standardized network protocol used on Internet Protocol (IP) networks. The DHCP protocol is controlled by a DHCP server that dynamically distributes network configuration parameters, such as IP addresses, for interfaces and services.</p>

11	<p><b>What is HTTP</b>  <i>(Hyper Text Transfer Protocol):</i> The HTTP protocol is used for communications between a web server and the client-side application running on a web browser.  <b>SMTP</b> <i>(Simple Mail Transfer Protocol):</i> The SMTP protocol is used for sending and receiving e-mails by a mail client.</p>
12	<p><b>What is Route Optimization? <u>APR/MAY 2017</u></b>  Route optimization enables the datagrams to be routed directly in both directions. Route optimization also provides support for smooth handoffs by letting the previous foreign agent tunnel datagrams to mobile node's current location.</p>
13	<p><b>What is the purpose of HLR? <u>NOV/DEC 2018</u></b>  The Home Location Register (HLR) is the main database of permanent subscriber information for a mobile network. The HLR is an integral component of CDMA (code division multiple access), TDMA (time division multiple access), and GSM (Global System for Mobile communications) networks.</p>
14	<p><b>What is the key mechanism in Mobile IP? <u>NOV/DEC 2018</u></b>  Discovering the care-of-address Registering the care of-address Tunneling the care-of address</p>
15	<p><b>Which layer do each of the following protocols belong to? What is their functionality? <u>NOV/DEC2017</u></b></p> <p><b>1. RARP – Internet layer</b>  <b>RARP</b> <i>(Reverse Address Resolution Protocol):</i> The RARP protocol is used by IP to find the IP address based on the physical (MAC address) address of a computer.</p> <p><b>2. DNS – Application layer</b>  .It stands for <b>Domain Name System</b> (or <b>Service</b> or <b>Server</b>). It is a software service available on the Internet that is responsible for translating domain names into IP addresses. DNS service hosted on the Internet translates the domain name into the corresponding IP address, since, after all, the Internet works using IP addresses</p>
16	<p><b>Define COA? <u>NOV/DEC 2016</u></b>  <b>Care-of-Address (COA):</b> It is the address that is used to identify the present location of a foreign agent. The packets sent to the MN are delivered to COA.  The COA can be any of the following two types:  (a) <i>Foreign agent COA:</i> The COA is an IP address of foreign agent (FA).  (b) <i>Co-located COA:</i> When the mobile node (MN) acquires a temporary IP address, that address acts as the COA.</p>
17	<p><b>Define T-TCP?</b>  A protocol which is efficient and is used in situations where short messages are to be sent in sequence and a packet is delivered after the SYN and SYN_ACK packet exchanges and the connection closes after the packet exchanges of FIN, FIN_ACK, and CLOSING.</p>

18	<p><b>What are the features of TCP?</b>  The main features of TCP are:  1) Transmission as data Streams  2) Buffering and retransmission  3) Session-start, data transfer, and session-finish fully acknowledged end to end  4) In-order delivery  5) Congestion Control and avoidance</p>
19	<p><b>What are the configuration parameters to adapt TCP to wireless environments?</b>  Large Windows Limited Transmit Large MTU  Selective Acknowledgement Explicit Congestion Notification Timestamp  No header compression</p>
20	<p><b>What are the applications of satellites?</b>  Weather forecasting Radio and TV broadcast  Military satellites  Satellites for navigation</p>
<b>PART-B</b>	
1	<p>Explain the key mechanism of mobile IP with the help of a suitable schematic diagram and by using suitable examples. What are the disadvantages of mobile IP?(Pg no:68) <b><u>NOV/DEC 2016</u></b></p>
2	<p>Illustrate packet delivery mechanism in Mobile IP network with neat diagram? (Pg no:68) <b><u>APR/MAY 2017 ,NOV/DEC 2017</u></b></p>
3	<p>comparison of various TCP advantages and disadvantages in wireless networking? (Pg no:92) <b><u>NOV/DEC 2016</u></b></p>
4	<p>What are the main functions of DHCP? Why is DHCP needed? Can it be used when nodes are mobile? Explain your answer.  Explain how mobile IP is different from DHCP. State some applications of DHCP.(Pg no:74) <b><u>MAY/JUNE 2016</u></b></p>
5	<p>Explain the various improvements in TCP performance with diagram? How does it maintain end to end semantics?(Pg no:90) <b><u>MAY/JUNE 2016 , NOV/DEC 2017, APR/MAY 2018</u></b></p>
6	<p>Explain IP-in-IP , minimal IP and GRE encapsulation methods? (Pg no:67) <b><u>MAY/JUNE 2016, APR/MAY 2017</u></b></p>
7	<p>Explain the Architecture of TCP/IP? (Pg no:82) <b><u>MAY/JUNE 2016</u></b></p>
8	<p>Explain Indirect TCP(I-TCP) with the help of suitable diagram(Pg no:85) <b><u>APR/MAY 2018, NOV/DEC2018</u></b></p>
9	<p>Explain the agent discovery process in Mobile IP(Pg no:74) <b><u>APR/MAY 2018</u></b></p>

## UNIT III

### MOBILE NETWORK LAYER

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks ( VANET) –MANET Vs VANET – Security.

S. No.	Question
1	<b>List GSM services?</b> Bearer services Tele services Supplementary services
2	<b>What are the entities of operation sub system (OSS)?</b> Operation and maintenance center Authentication center Equipment Identity Register
3	<b>List out the different interfaces present in GSM? A interface</b> <b>Abis</b> interface <b>O</b> interface
4	<b>List out the different subsystems of GSM? <u>NOV/DEC 2018</u></b> Radio sub system (RSS) Network and switching subsystem (NSS) Operation subsystem (OSS).
5	<b>What are the services offered by GPRS? <u>NOV/DEC2017</u></b> GPRS offers end-to-end packet-switched data transfer services which can be categorized into the following two types: <b>Point-to-Point (PTP) service</b> <b>Point-to-Multipoint (PTM) service</b>
6	<b>Name the Tele Services provided by GSM? <u>APR/MAY 2017</u></b> <ol style="list-style-type: none"><li>1. Telephony</li><li>2. Emergency Number</li><li>3. Short Message services</li><li>4. Fax</li></ol>
7	<b>What is HLR? <u>NOV/DEC 2018</u></b> The home location register is a database used for mobile user information management. An HLR record consists of three types of information Mobile station information Location information Service information
8	<b>What is IMEI?</b> The IMEI is international mobile equipment identity number and which is used to identify the Mobile Station (MS).
9	<b>What is VLR overflow?</b> The VLR associated to each MSC is a dynamic database which stores all important information needed for the MS users currently in the LA that is associated to the MSC. If a new MS comes into an LA the VLR is responsible for, it copies all relevant information for this user from the HLR

10	<p><b>What is Authentication Center (AUC)?</b>  The <b>Authentication Center</b> is mainly used for security. The AUC contains the algorithms for authentication as well as the keys for encryption and generates the values needed for user authentication in the HLR</p>
11	<p><b>What is multicasting? <u>NOV/DEC2016</u></b>  Multicasting is the networking technique of delivering the same packet simultaneously to a group of clients. In this case there is may be one or more senders, and the information is distributed to a set of receivers (there may be no receivers or any other number of receivers).</p>
12	<p><b>What are the services provided by supplementary services? <u>NOV/DEC2016</u></b></p> <ul style="list-style-type: none"> <li>● User identification</li> <li>● Call redirection</li> <li>● Call forwarding</li> <li>● Closed user group</li> </ul> <p>Multiparty communication</p>
13	<p><b>List GSM Network management functions?</b>  BSS function for BSS management HLR function for HLR management  VLR function for VLR management, MSC function, AUC function, Call recording function.</p>
14	<p><b>Define Handoff. What are its types? <u>NOV/DEC2017</u></b>  A handoff refers to the process of transferring an active call or data session from one cell in a cellular network to another or from one channel in a cell to another. A well-implemented handoff is important for delivering uninterrupted service to a caller or data session user.</p> <ul style="list-style-type: none"> <li>● Hard Handoff: Characterized by an actual break in the connection while switching from one cell or base station to another. The switch takes place so quickly that it can hardly be noticed by the user. Because only one channel is needed to serve a system designed for hard handoffs, it is the more affordable option. It is also sufficient for services that can allow slight delays, such as mobile broadband Internet.</li> <li>● Soft Handoff: Entails two connections to the cell phone from two different base stations. This ensures that no break ensues during the handoff. Naturally, it is more costly than a hard handoff.</li> </ul>
15	<p><b>What are the information in SIM? <u>APR/MAY 2018</u></b> Card type, serial no.,  list of subscribed services Personal identity number  Pin unlocking key, Authentication key</p>
16	<p><b>What is IMSI?</b>  IMSI is the unique subscriber identity that identifies the HLR of the MSI. TMSI (temporary mobile subscriber identity) is used to avoid sending the IMSI on the radio path.</p>
17	<p><b>List three important features of GSM security? <u>MAY/JUNE 2016</u></b>  Authentication  Confidentiality Anonymity</p>

18	<b>What are the four types of handover available in GSM?</b> <ul style="list-style-type: none"><li>● Intra cell handover</li><li>● Inter cell intra BSC handover</li><li>● Inter BSC Intra MSC handover</li><li>● Inter MSC handover</li></ul>
19	<b>What do you mean by Roaming?</b> <p>Moving between access points is called roaming. Even wireless networks may require more than one access point to cover all rooms. In order to provide uninterrupted services, we require roaming when the user moves from one access point to another.</p>
20	<b>What are the categories of Mobile services?</b> <p>Bearer services Tele services Supplementary services</p>

1	Explain in detail about the system architecture of GSM.[ <b><u>MAY/JUNE 2016, NOV/DEC 2016, APR/MAY 2017, NOV/DEC2017,NOV/DEC 2018</u></b> ] Pg- 35
2	Explain about the architecture of GPRS? [May2014]. Pg- 41
3	Discuss the architecture of UMTS? pg- 42 <b><u>MAY/JUNE 2016, NOV/DEC 2017, APR/MAY2018</u></b>
4	Explain about the various handover by GSM? Pg- 36 <b><u>NOV/DEC 2016, APR/MAY2018</u></b>
5	What kind of security will be provided for GSM? Explain. Pg- 40 <b><u>MAY/JUNE 2016 NOV/DEC2016</u></b>
6	Explain about the protocol architecture of GPRS? Pg- 34 <b><u>MAY/JUNE 2016, NOV/DEC 2016, APR /MAY 2017</u></b> ]
7	Explain about the GSM services ? Pg -33
8	Explain about inter cell and intra cell handovers n GSM ? Pg- 36
9	Discuss about the interfaces in UMTS pg- 42
10	Explain about MOT and MTO in GSM pg- 38
11	Explain about protocol architecture of GSM Pg- 37
12	Explain about call forwarding in GSM Pg- 39
13	Explain about the types of protocols used in GPRS Pg- 41
14	Describe the function of HLR and VLR in call routing and roaming? pg- 36 <b><u>NOV/DEC 2018</u></b>
15	Explain the working of UMTS ? pg- 42



## UNIT IV

### MOBILE TRANSPORT AND APPLICATION LAYER

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA  
Architecture – WML

S. No.	Question
1	<p><b>What is Ad-Hoc ?</b></p> <p>In a simplistic realization of this concept, a mobile device wanting to communicate can forward its packets to its neighbours, and the neighbour nodes in turn can forward those to their neighbours, and so on until the destination is reached.</p>
2	<p><b>Define MANET.</b></p> <p>A mobile ad hoc network (<b>MANET</b>) is a continuously self- configuring, infrastructure-less network of mobile devices connected without wires.</p> <p>However, of late several specialized MANETs such as Wireless Sensor Networks (WSNs) and Vehicular Ad hoc Networks (VANETs) have emerged. Each of these specialized ad hoc networks is suitable for a specific kind of application.</p>
3	<p><b>Define VANET.</b></p> <ul style="list-style-type: none"><li>- The Vehicular Ad-Hoc Network, or <b>VANET</b>, is a technology that uses moves cars as nodes in a network to create a mobile network.</li><li>- Each of these specialized ad hoc networks is suitable for a specific kind of application.</li><li>-Being ad hoc networks after all, all these networks share some basic characteristics. However, there exist significant differences among them with respect to their operation, design, and applications.</li></ul>
4	<p><b>List the Characteristics of mobile Adhoc Network ? <u>MAY/JUNE 2016</u></b></p> <p>There are several characteristics that distinguish a MANET from an</p> <p><b>1. Lack of fixed infrastructure:</b> Lack of any specific networking infrastructure is possibly the most distinguishing characteristic of a</p>

	<p>MANET.</p> <p>2. <b>Dynamic topologies:</b> Since the devices in a MANET are allowed to move arbitrarily, the network topology can change unpredictably.</p> <p>3. <b>Bandwidth constrained, variable capacity links:</b> Wireless links have significantly lower capacity than their wired counterparts.</p> <p>4. <b>Energy constrained operation:</b> The nodes in a MANET rely on battery power. These batteries are small and can store very limited amounts of energy.</p> <p>5. <b>Increased vulnerability:</b> MANETs are prone to many new types of security threats that do not exist in the case of their wired counterparts..</p> <p>6. <b>Other characteristics:</b> Other distinguishing characteristics of a MANET include a distributed peer-to-peer mode of operation, multi-hop routing, and relatively frequent changes to the concentration of nodes over any specific area.</p>
5	<p><b>What are the Applications of MANETs <u>APR/MAY 2017</u></b></p> <p>A MANET can be set up quickly since no fixed infrastructures need to be deployed.</p> <p>Thus, in any situation where fixed infrastructure becomes difficult to be set up because of security, cost, inaccessibility of the terrain, or safety-related reasons, ad hoc networks become the preferred choice.</p> <p>Of the large number of applications that are possible with MANETs, a few example applications are defence-related operations and disaster management application</p> <p><b>1.Communication among portable computers</b></p> <p>Miniaturization has allowed the development of many types of portables and computerized equipment, which have become very popular. Many of these portables work meaningfully when connected to some network, possibly a LAN or the Internet.</p> <p>For this, the portables are typically required to be within the range of some wireless hub.</p> <p>- Satisfaction of this requirement would, however, drastically reduce the flexibility and the mobility of the devices. As an example, consider a lecture room where no networking infrastructures exist.</p> <p><b>2.Environmental monitoring</b></p> <p>A popular category of applications of MANETs is the collection of</p>

	<p>the various types of data about the environment in which they are deployed.</p> <p>Continuous data collection from remote locations is considered important for several applications such as environmental management, security monitoring, road traffic monitoring and management, etc.</p> <p><b>3.Military</b></p> <p>-The present-day military equipment have become quite sophisticated, have many automated parts and contain one or more computers.</p> <p>-This opens up the scope of setting up an ad hoc network consisting of various military equipment deployed in a frontline battle field. Ad hoc networking of these equipment can allow a military setup to take advantage of an information network among the soldiers, vehicles, and military information headquarters.</p> <p>- For example, an ad hoc network can be automatically set up at a battlefield among the equipment, and the hand-held devices can collect information from and disseminate command to the frontline personnel.</p> <p><b>4.Emergency applications</b></p> <p>-Ad hoc networks do not require any pre-existing infrastructure.</p> <p>-These networks, therefore, can be deployed easily and rapidly in emergency situations such as a search and rescue operation after a natural disaster, and for applications such as policing and fire fighting. In these situations, ad hoc networks can be set up on the fly.</p>
6	<p><b>What are the MANET Design Issues? <u>NOV/DEC2018</u></b></p> <p>We point out below a few important issues that are relevant to the design of suitable MANET protocols.</p> <p><b>1.Network size and node density</b></p> <p><b>2.Connectivity</b></p> <p><b>3.Network topology</b></p> <p><b>4.User traffic</b></p> <p><b>5. Operational environment</b></p> <p><b>6. Energy constraint</b></p>
7	<p><b>What is Routing ? and purpose of Routing ?</b></p>

	<p>Packet routing is usually a much more complex task in an ad hoc network compared to that of an infrastructure-based network.- main complications arise on account of continual topology changes and limited battery power of the nodes. Recall that we discussed these issues in Section 7.4 and a few other issues that are inherent to MANETs.</p> <p>- When the destination node is not in the transmission range of the source node, the route has to be formed with the help of the intervening nodes in the network.</p> <p>-As we know, the purpose of routing is to find the best path between the source and the destination for forwarding packets in any store- and-forward network.</p>
8	<p><b>What are the Several types of routing protocols have been proposed for MANETs.?</b></p> <p>Different routing protocols essentially implement the above steps (a) and (b) while meeting the constraints inherent to the network, such as low energy consumption, through the deployment of various techniques.</p> <p>-We will now review the essential concepts of a traditional routing technique.</p> <p>Later, we will build upon these concepts to introduce the routing protocols for ad hoc networks. No simple IP-address based routing is possible in a MANET due to the continual topology changes on account of node movements.</p>
9	<p><b>What are the essentials needs of traditional routing Protocols</b></p> <p>- It is necessary to have a clear understanding of the routing mechanisms deployed in a traditional network.</p> <p>It will help us appreciate the specific changes made to traditional routing protocols to support the specific requirements of an ad hoc network.</p> <p>Two important classes of routing protocols for traditional networks are the <i>link state</i> and the <i>distance vector</i>. These two protocols are extremely popular in packet-switched networks.</p> <p>Both these protocols require a node to determine the next hop along the “shortest path” towards a given destination. The shortest path is computed according to some specific cost metric such as the number of hops in the route.</p>
10	<p><b>Define link state protocols (LSP)</b></p> <p>-The term <i>link state</i> denotes the state of a connection of one router with one of its neighbours.</p> <p>- A neighbour of a router is one with which it can directly communicate without taking any help from the intervening routers. Each router determines its local connectivity information, and floods the network with this information with a <i>link state</i></p>

	<p><i>advertisement.</i></p> <p>- As a router in the network receives this link state advertisement, it stores this packet in a link state packet database (LSPDB).</p> <p>-This storage of link state advertisements in an LSPDB is in addition to the routing table that each router maintains.</p>
11	<p><b>Draw the schematic diagram of a router ?</b></p> <ul style="list-style-type: none"> <li>• A unique <i>sequence number</i>, which is formed by increasing the count every time the router forms a new link state advertisement.</li> <li>* This link state advertisement is then flooded throughout the network as follows: A router sends a copy of a link state advertisement to all of its neighbours.</li> </ul> <p>-A router receiving this message examines the sequence number of the last link state advertisement from the originating router by consulting its LSPDB.</p>
12	<p><b>Compare AODV &amp; DSR protocols? <u>NOV/DEC2017</u></b></p> <ul style="list-style-type: none"> <li>• DSR has less routing overhead than AODV</li> <li>• AODV has less normalized MAC overhead than DSR.</li> <li>• DSR is based on a source routing mechanism whereas AODV uses a combination of DSR and DSDV mechanisms.</li> <li>• AODV has better performance than DSR in higher-mobility</li> </ul>
13	<p><b>Difference Between MANET Vs VANET <u>MAY/JUNE 2016</u> , <u>NOV/DEC 2016</u>, <u>APR/MAY2018</u></b></p> <p>-A MANET, as we have already defined, is a collection of mobile nodes that communicate with each other over bandwidth constrained wireless links without any infrastructure support.</p> <p>-In this sense, we can consider a VANET to be a special category of MANET. The nodes are mobile in</p> <p>- VANETs as well as in MANETs. However, the VANET nodes (vehicles) can communicate with certain roadside infrastructures or base stations.</p> <p>- Further, the node mobility in a VANET is constrained to the road topologies, whereas the movement of nodes in a MANET is more random in nature.</p>
14	<p><b>What are the Types of communications?</b></p> <p>In a network, a node can initiate the following types of communications:</p> <p><i>Unicast:</i> In this, a message is sent to a single destination node.</p> <p><i>Multicast:</i> In this type of transmission, a message is sent to a selected subset of the network nodes.</p>

	<p><i>.Broadcast:</i> In this type of transmission, a message is sent to all the nodes in the network. Since unrestrained broadcast communications can choke a MANET, applications usually do not use broadcast communication.</p>
15	<p><b>Difference Between Proactive &amp; Reactive protocols <u>APR/MAY 2017</u></b></p> <p><b><i>Proactive (table-driven) protocols</i></b></p> <p>A proactive routing protocol is also known as a <i>table-driven</i> routing protocol. In this protocol, each node in a routing table maintains information about routes to every other node in the network. These tables are periodically updated in the face of random network topology changes. An example of a proactive (table-driven) protocol is the Destination Sequenced Distance Vector (DSDV) protocol.</p> <p><b><i>Reactive (on-demand) protocols</i></b></p> <p>A reactive routing protocol is also known as an on-demand routing protocol, since in this protocol nodes do not maintain up-to-date routes to different destinations, and new routes are discovered only when required.</p> <p>When a node does not have knowledge about any route to a specific destination, it uses a flooding technique to determine the route.</p>
16	<p><b>What is Hybrid routing protocols</b></p> <ul style="list-style-type: none"> <li>- Hybrid routing protocols have the characteristics of both proactive and reactive protocols. These protocols combine the good features of both the protocols.</li> <li>- The hybrid routing protocols are designed to achieve increased scalability by allowing nodes with close proximity to work together to form some sort of a backbone to reduce the route discovery overheads.</li> </ul>
17	<p><b>What are the Popular MANET Routing Protocols:</b></p> <p>A few popular MANET routing protocols</p> <ol style="list-style-type: none"> <li>1. Destination-Sequenced Distance-Vector Routing Protocol</li> <li>2. Dynamic Source Routing (DSR) Protocol.</li> <li>3. Ad Hoc On-demand Distance Vector (AODV).</li> <li>4. Zone Routing Protocol</li> </ol>

	<b>5. Multicast Routing Protocols for MANET</b>
18	<p><b>Write the Important steps in the operation of DSDV? <u>NOV/DEC2018</u></b></p> <p>The important steps in the operation of DSDV are summarized below:</p> <ol style="list-style-type: none"> <li>1. Each router (node) in the network collects route information from all its neighbours.</li> <li>2. After gathering information, the node determines the shortest path to the destination based on the gathered information.</li> <li>3. Based on the gathered information, a new routing table is generated.</li> <li>4. The router broadcasts this table to its neighbours. On receipt by neighbours, the neighbour nodes recompute their respective routing tables.</li> <li>5. This process continues till the routing information becomes stable.</li> </ol>
19	<p><b>What are the contents of link state advertisement message? <u>NOV/DEC2017</u></b></p> <p>All link state advertisements begin with a common 20 byte header.</p> <p>This header contains enough information to uniquely identify the advertisement (LS type, Link State ID, and Advertising Router).</p> <p>Multiple instances of the link state advertisement may exist in the routing domain at the same time. It is then necessary to determine which instance is more recent.</p>
20	<p><b>What is the concept of RTT? <u>NOV/DEC 2016</u></b></p> <p>Round-trip time (RTT), also called round-trip delay, is the time required for a signal pulse or packet to travel from a specific source to a specific destination and back again. In this context, the source is the computer initiating the signal and the destination is a remote computer or system that receives the signal and retransmits it.</p>

1	Explain about characteristics and applications of MANET? Pg - 118 <u>MAY/JUNE 2016.</u> <u>APR/MAY2018</u>
2	Explain, Compare and contrast the traditional routing protocols? <u>NOV/DEC 2016</u>
3	Explain how routing is done in MANET? Explain about DSR in detail and compare with DSDV ? <u>MAY/JUNE2016.NOV/DEC2017.NOV/DEC2018</u>
4	Explain the various MANET routing protocols with advantages and disadvantages? <u>NOV/DEC2016</u>
5	What is VANET? Differentiate MANET and VANET? Architecture of VANET? <u>MAY/JUNE 2016. NOV/DEC2017. APR/MAY2018</u>
6	Explain the security issues and attacks in MANET & VANET? <u>MAY/JUNE 2016</u>
7	Explain the Design issues of MANET routing protocols in detail? <u>APR/MAY 2017.</u> <u>APR/MAY2018</u>
8	Explain the various VANET routing protocols in detail ? <u>APR/MAY 2017</u>
9	Illustrate the process of route discovery, route reply, data delivery and route caching using DSR <u>(notes) APR/MAY2018</u>
10	Explain about the On demand routing protocols?
11	Explain about the Proactive routing protocols?
12	Explain about the attacks in MANET
13	Explain in detail about architecture of VANET and various security attacks on VANET ?
14	Explain about the multicast routing protocol
15	Differentiate VANET and MANET



## UNIT V

### MOBILE PLATFORMS AND APPLICATIONS

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

S. No.	Question
1	<p><b>What are the layers of Operating System?</b></p> <p>The operating system is usually structured into a kernel layer and a shell layer. The shell essentially provides facilities for user interaction with the kernel. The kernel executes in the supervisor mode and can run privileged instructions that could not be run in the user mode.</p>
2	<p><b>Why is kernel mode called memory resident part?</b></p> <p>During booting, the kernel gets loaded first and continues to remain in the main memory of the device. This implies that in a virtual memory system, paging does not apply to the kernel code and kernel data. For this reason, the kernel is called the <i>memory resident</i> part of an operating system.</p>
3	<p><b>What is monolithic kernel design?</b></p> <p>In a monolithic kernel OS design, the kernel essentially constitutes the entire operating system code, except for the code for the shell. The principal motivation behind this monolithic design was the belief that in the supervisor mode, the operating system services can run more securely and efficiently.</p>
4	<p><b>What is M- commerce? <u>MAY/JUNE 2016.APR/MAY 2018</u></b></p> <p>Mobile e-commerce (m-commerce) is a term that describes online sales transactions that use wireless electronic devices such as hand-held computers, mobile phones or laptops. These wireless devices interact with computer networks that have the ability to conduct online merchandise purchases. Any type of cash exchange is referred to as an e-commerce transaction. Mobile e- commerce is just one of the many subsets of electronic commerce. Mobile e- commerce may also be known as mobile commerce</p>
5	<p><b>What are Special Constraints of Mobile O/S <u>APR/MAY 2017, NOV/DEC 2017, APR/MAY2018</u></b></p> <p>Limited memory Limited screen size            Miniature keyboard            Limited processing power Limited battery power            Limited and fluctuating bandwidth of the wireless medium</p>

6	<p><b>What are the requirements of Mobile O/S <u>APR/MAY 2017</u></b>  Support for specific communication protocols Support for a variety of input mechanisms Compliance with open standards  Extensive library support</p>
7	<p><b>list the important features of the Windows mobile OS <u>NOV/DEC2018</u></b>  • The Graphics/Window/Event manager (GWE) component handles all input and output.  • Provides a virtual memory management.  • Supports security through the provision of a cryptographic library.  • Application development is similar to that in the Win32 environment. support true multitasking in the future versions of the Windows Phone operating system.</p>
8	<p><b>list the pros &amp; cons of M- commerce? <u>APR/MAY 2017.APR/MAY 2018</u></b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Providing a wider reach or Accessibility</li> <li><input type="checkbox"/> Reducing the transaction cost</li> <li><input type="checkbox"/> Ubiquity</li> <li><input type="checkbox"/> Personalization.</li> <li><input type="checkbox"/> Reducing time.</li> </ul> <p><b><u>Cons:</u></b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Limited Speed</li> <li><input type="checkbox"/> Small Screen SizeNo standard for M-commerce</li> <li><input type="checkbox"/> Technology constraints of devices</li> </ul>
9	<p><b>What is Symbian OS?</b>  Symbian OS is a real time, multitasking, pre-emptive, 32-bit operating system that runs on ARM-based processor designs. The inherent design of the Symbian operating system is microkernel-based.</p>
10	<p><b>What are the flavours of Symbian OS Series 60</b>  <b>UIQ interface:</b> UIQ (earlier known as User Interface Quartz)</p>
11	<p><b>What is Series 60?</b>  The series-60 platform was until recently the leading smartphone platform in the world. The relatively large sized colourscreen, easy-to- use interface and an extensive suite of applications make it well-suited to support advanced features such as rich content downloading and MMS (Multimedia Messaging Service). Series 60 was mainly being used on Nokia’s smartphones and Samsung handsets.</p>

12	<p><b>What are the features of BlackBerry OS? <u>NOV/DEC2018</u></b></p> <ul style="list-style-type: none"> <li>• touchscreen</li> <li>• Multitasking.</li> <li>• BlackBerry Hub</li> <li>• Third-party applications</li> <li>• Released Devices</li> </ul> <p>Canceled devices</p>
13	<p><b>What is POS? <u>NOV/DEC 2016</u></b></p> <p>Point-of-Sale (PoS) usually means a checkout counter in a shop or supermarket. More specifically, the point-of-sale often refers to the hardware and software used for handling customer purchases at the checkout desks. An example of a PoS terminal is an electronic cash register. Nowadays, the point-of-sale systems are used in almost every supermarket and are used in many retail stores too.</p>
14	<p><b>What are the advantages and disadvantages of BlackBerry OS? <u>NOV/DEC 2017</u></b></p> <p><i>Pros</i>      Excellent Connectivity (Messengers viz BBM, yahoo, gtalk, whatsapp work seamlessly)      Amazing email client (can also sync with your enterprise server) Most user friendly      qwerty keyboard (easy typing)      Very fast and snappy</p> <p><i>Cons</i>      Battery life not great in some models Camera quality      not great Application support is bad      Almost all models have similar utility and features. (Minor change in visuals cz of the new OS).</p>
15	<p><b>What is iOS?</b></p> <p>iOS is a closed and proprietary operating system fully owned and controlled by Apple and not designed to be used by various mobile phone vendors on their systems.</p>
16	<p>Structure of ANDROID stack:</p> <div style="text-align: center; border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; width: 80%;">Application Layer</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; width: 80%;">Application Framework</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; width: 80%;">Libraries and Runtime</div> <div style="border: 1px solid black; padding: 5px; width: 80%;">Kernel</div> </div>
17	<p><b>Define Dalvik VM:</b></p> <p>Dalvik translates a Java application program into machine code of the mobile device and executes it by invoking the operating system.</p> <p>These can be compiled to ARM native code and installed using the Android native development kit (SDK).</p>

18	<p><b>Define Android kernel</b></p> <p>Android kernel has been developed based on a version of Linux kernel. It has excluded the native X Window System and does not support the full set of standard GNU libraries. This makes it difficult to reuse the existing Linux applications or libraries on Android. Based on the Linux kernel code, Android implements its own device drivers, memory management, process management and networking functionalities. Android is multitasking and allows applications to run concurrently.</p>
19	<p><b>What is Business-to-consumer (B2C)?</b></p> <p>Business-to-consumer (B2C) is a form of commerce in which products or services are sold by a business firm to a consumer. B2C is an important category of mobile commerce applications and is reported to be nearly half of the total M-commerce market</p>
20	<p><b>List the Examples of B2C?</b></p> <p>Advertising Comparison shopping Information about a product Mobile ticketing Loyalty and payment services Interactive advertisements Catalogue shopping</p>

**PART-B**

1	Explain about Android OS , features, software stack , SDK and their layers <b><u>MAY/JUNE 2016, NOV/DEC 2017,NOV/DEC2018</u></b>
2	Compare & contrast various popular mobile OS <b><u>NOV/DEC2016, APR/MAY 2017</u></b>
3	What is RFID? Explain the few applications in which RFID is useful? (notes) <b><u>NOV/DEC2016</u></b>
4	Explain the special constraints and requirements, components of Mobile OS <b><u>MAY/JUNE 2016</u></b>
5	Explain in detail about M Commerce, its applications, advantages and disadvantages <b><u>MAY/JUNE 2016 , NOV/DEC2016, APR/MAY 2017, NOV/DEC2018</u></b>
6	Explain the mobile payment systems and payment schemes <b><u>MAY/JUNE 2016 , NOV/DEC2016, NOV/DEC2017, APR/MAY2018, NOV/DEC2018</u></b>
7	Explain in detail components of iphone OS? List the special features of a Mobile OS? <b><u>APR/MAY2018</u></b>
8	Explain the features of Andriod OS?
9	Explain the features of Mobile OS <b><u>NOV/DEC2018</u></b>
10	Discuss about the constraints of Mobile OS
11	Explain about the various payment schemes
12	Explain android software stack with neat diagram? <b><u>NOV/DEC 2018</u></b>
13	List the Features required of a mobile device to enable mobile commerce
14	Explain the types of M-payment schemes ?
15	Explain in detail about iphone OS?