CS8601 MOBILE COMPUTING L T P C
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OBJECTIVES:

The student should be made to:

- To understand the basic concepts of mobile computing.
- To learn the basics of mobile telecommunication system .
- To be familiar with the network layer protocols and Ad-Hoc networks.
- To know the basis of transport and application layer protocols.
- To gain knowledge about different mobile platforms and application development.

UNIT I - INTRODUCTION 9

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 INTERNET PROTOCOL AND TRANSPORT LAYER 9

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

UNIT III - MOBILE TELECOMMUNICATION SYSTEM 9

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 AD-HOC NETWORKS 9

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

UNIT V - MOBILE PLATFORMS AND APPLICATIONS 9

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

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Explain the basics of mobile telecommunication systems
- Illustrate the generations of telecommunication systems in wireless networks
- Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network
- Explain the functionality of Transport and Application layers
- Develop a mobile application using android/blackberry/ios/Windows SDK

TEXT BOOK:

1.Jochen Schiller, ―Mobile Communications‖, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012

REFERENCES:

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
3. William.C.Y.Lee,"Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition,Tata Mc Graw Hill Edition ,2006.
4. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.
5. Android Developers : http://developer.android.com/index.html
6. Apple Developer : https://developer.apple.com/
7. Windows Phone Dev Center : http://developer.windowsphone.com
8. BlackBerry Developer : http://developer.blackberry.com/

Subject Code: CS 8601 **Year / Sem : III / 6**
Subject Name: Mobile Computing **Subject Handler: Ms. Suganya M**

UNIT I INTRODUCTION

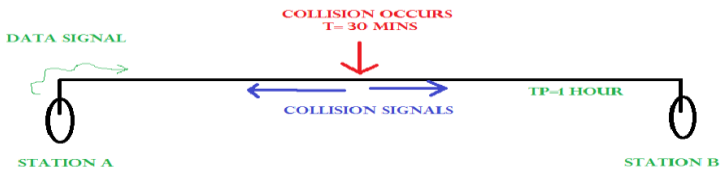
Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA

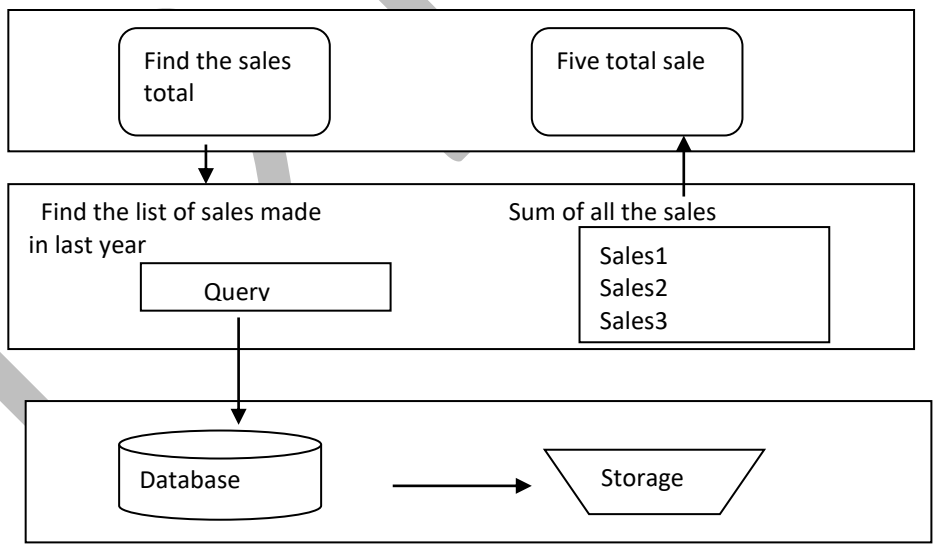
PART * A

Q.No	Questions
1	**Define mobile computing.** BTL 1 It is defined as the capability to change location while communicating to invoke computing services at some remote computers. It is a technology that allows transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link.
2	**List the advantage of mobile computing.** BTL 1 **(May/June 2016)** • Increase in Productivity • Entertainment • Portability • Cloud Computing
3	**Give the properties of MAC protocols.** BTL 2 • It should help maximize the utilization of channels • 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.
4	**Give some mobile computing applications.** BTL 2 • Emergency services • Vehicles. • CDPD – Cellular Digital Packet Data
5	**What is Mobility?** BTL 1 A person who moves • Between different geographical locations • Between different networks • Between different communication devices • Between different applications A device that moves • Between different geographical locations • Between different networks
6	**What is wireless communication?** BTL 1 Wireless communication is the transfer of information over a distance without the use of electrical conductors or wires. The distance involved may be short or long lines.

<table>
<tr><td>7</td><td>List the characteristics of mobile computing. BTL 1
Ubiquity
Location awareness
Adaptation
Broadcast
Personalization</td></tr>
<tr><td>8</td><td>How MAC protocols are classified? BTL 3
They are classified into
Fixed assignment schemes
Random assignments schemes
Demand – based schemes</td></tr>
<tr><td>9</td><td>Differentiate between wired network and mobile. BTL 2 (APR/MAY 2017)
<table>
<tr><th>Wired network</th><th>Mobile network</th></tr>
<tr><td>1. High bandwidth</td><td>1. Low Bandwidth</td></tr>
<tr><td>2. High power machines</td><td>2. Low power machines</td></tr>
<tr><td>3. Can listen on wire</td><td>3.Hidden terminal problem</td></tr>
<tr><td>4. Connected operation</td><td>5. Disconnected operation</td></tr>
</table></td></tr>
<tr><td>10</td><td>What are the functions of mobile computing? BTL 1
Session mobility
Device mobility
Service mobility
Host mobility</td></tr>
<tr><td>11</td><td>State the issues of wireless MAC protocols. BTL 1
Hidden terminal problem
Exposed
Near & Far</td></tr>
<tr><td>12</td><td>Give some examples for fixed assignment and random Assignment schemes. BTL 1
FAS- FDMA, TDMA, CDMA
RAS – Aloha and CSMA.</td></tr>
<tr><td>13</td><td>What is the advantage of TDMA? BTL 1
Flexible bit rate
No frequency guard band required
Extended battery life
Easy for mobile or base stations to initiate and execute hand off</td></tr>
<tr><td>14</td><td>What is the disadvantage of using FDMA? BTL 1
The presence of guard signals.
Maximum bit rate per channel is fixed.
Requires right RF filtering to minimize adjacent channel interference.</td></tr>
</table>

15	**List various Random Assignment schemes in MAC.** BTL 1 **(Nov/dec2016)** • ALOHA • Slotted ALOHA • CSMA • CSMA/CD • CSMA/CA
16	**What are the limitations of Mobile Computing?** BTL 1 **(Nov/dec2016)** **Wireless Medium** • Cost of Networks • Quantity and reliability of bandwidth • Environment obstacles **Portability -Mobile Restrictions** • Low Resources • Battery Constraint
17	**Why do Hidden and Exposed terminal problem arise.** BTL 1 **(May/June 2016)** Hidden terminal problem is due to the fact that a node (say A) transmitting to another node (say B) cannot hear transmissions from another node C, which might also be transmitting to B, and might interfere with the A-to-B transmissions. Exposed node problem occurs when a node is prevented from sending packets to other nodes because of a neighboring transmitter.
18	**Show that Barker code has good auto correlation.** BTL 3 When the receiver attempts to correlate the received coded symbols with respect to any of the codes which it internally generates, it is not able to correlate even when it uses exactly the same code as the one used for transmission. • Reasons for no correlation • Propagation delay • Inappropriate code
19	**Give the difference between 1G, 2G, 2.5G, 3G mobile network communications.** BTL 1 1G –Voice -only communication. 2G –Communicate voice as well as data signals. 2.5G–Enhancements of the second generation and sport data rates up to 100 kpbs. 3G –Mobile devices communicate at even higher data rates and support voice, data, and multimedia streams. High data rates in 3G devices enable transfer of video clips and faster multimedia communication.
20	**What are the basic services provided by the MAC layer?** BTL 1 • Asynchronous data service (mandatory)

	• Time-bounded service (optional)
21	**Define Mobile Binding.** BTL 1 A binding created for providing mobility to a mobile node after registration at a foreign network.
22	**What is MAC?** BTL 1 Message authentication codes (MAC) are used to authenticate messages during transmission. MAC of a message is created using a cryptographic MAC function which is similar to the hash function but has different security requirements.
23	**Define MACA Protocol.** BTL 1 Multiple Access with Collision Avoidance (MACA) is a slotted media access control protocol used in wireless LAN data transmission to avoid collisions caused by the hidden station problem and to simplify exposed station problem.
24	**Define Collision Detection based protocol for wireless networks.** BTL 1 CSMA/CD (Carrier Sense Multiple Access/ Collision Detection) is a media-access control method widely used in Ethernet technology/LANs. 
25	**Compose a role which is played by Radio/Infrared signals play in Mobile Computing.** BTL 6 • Radio transmission uses radio-wave frequencies to send data directly between transmitters and receivers. • Infrared light -red light that is not commonly visible to human eyes. Red lights are used in remote controls.
	PART * B
Q.No	**Questions**
1	**Describe in detail about characteristics of mobile computing. (13M) (Nov/Dec2016)** BTL 4 **Answer**: **Page:28-31 - Prasant Kumar Pattnaik** **Definition: (2M)** A computing environment is said to be mobile, when either the sender or the receiver of information can be on the move while transmitting or receiving information. **Explanation (10M)** **Ubiquity: (2M)** Ability of a user - perform computations from anywhere - at any time.

	Location awareness: (2M) Hand held device equipped with global positioning system (GPS) - transparently provide information - current location of a user - tracking system. **Adaptation: (2M)** Ability of a system - adjust to bandwidth fluctuation - without inconveniencing user. **Broadcast: (2M)** Broadcast nature - underlying communication network - mobile computing environment, efficient delivery of data - made simultaneously to hundreds of mobile users. **Personalization: (2M)** Services in mobile environment - easily personalized - user's profile
2	**Explain different layers of structure of mobile computing Application. (13M) (May/June 2016)** BTL 1 **Answer**: **Page: 88- 110 - Prasant Kumar Pattnaik** **Definition: (2M)** A mobile computing application is usually structured in terms of the functionalities implemented. **Explanation: (6M)** Presentationtier, Application tier Data tier.  **Diagram(5M)**
3	**Write a short on the concepts of** **FDMA (3M)** **TDMA (2M)** **CDMA. (2M)** **SDMA. (2M)** BTL 2 **(APR/MAY 2017)** **Answer**: **Page: 56 -59 - Prasant Kumar Pattnaik**

Explanation (9M)

Fixed Assignment Schemes:

Important categories of fixed assignment MAC protocols:

- Frequency Division Multiple Access(FDMA)
- Time Division Multiple Access(TDMA)
- Code Division Multiple Access(CDMA)
- Spatial division multiple access (SDMA)

FDMA:

In FDMA - available bandwidth (frequency range) - divided into many narrower frequency bands called channels.

TIME DIVISION MULTIPLE ACCESS (TDMA):

TDMA - access method - multiple nodes - allotted different time slots - access the same physical channel - timeline divided into fixed time slots - divided among multiple nodes that can transmit.

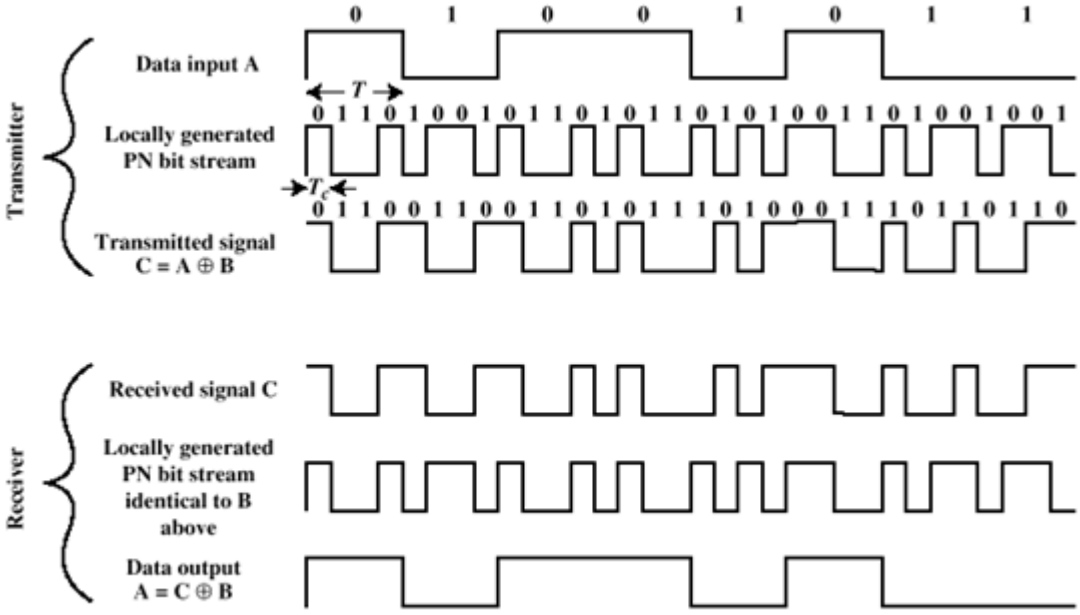
CDMA:

In CDMA - multiple users are allotted different codes - consist of sequences of 0 and 1 to access the same channel.

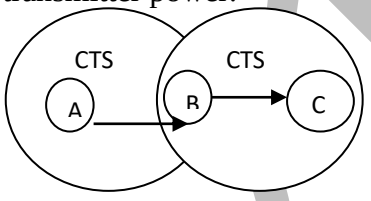
SDMA:

Spatial division multiple access (SDMA) - channel access method - mobile communication systems - reuses the same set of cell phone frequencies - given service area

Diagram (4M)

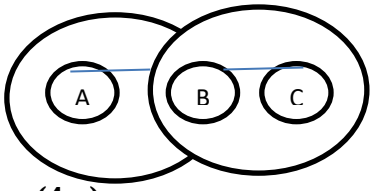


4	**Discuss in detail about Random assignment scheme and Reservation based schemes. (13M)** BTL 2 **Answer**: **Page: 59-61 - Prasant Kumar Pattnaik** **Random Assignment Schemes: (7M)** ALOHA Slotted ALOHA

	CSMA CSMA/CD CSMA/CA **ALOHA Scheme:** Simple communication scheme - developed at the University of Hawai - (also called pure) ALOHA scheme, is a simple protocol. **Slotted ALOHA:** slotted ALOHA scheme - chances of collisions are attempted - reduced by enforcing restrictions **CSMA** a node senses - medium before starting to transmit - senses that some transmission -already underway - it defers its transmission. **Reservation- based schemes: (6M)** A basic form of the reservation scheme is the RTS/CTS scheme. In an RTS/CTS scheme, a sender transmits an RTS (Ready to Send) packet to the receiver before the actual data transmission. **MACA** MACA - Multiple Access Collision Avoidance. MACA solves - hidden/exposed terminal regulating - transmitter power. Radio range of A  Radio Range of C
5	**Describe in detail about MAC protocols issues. (13M)** BTL 4 **(APR/MAY 2017)** **Answer**: **Page:207 -209 - Prasant Kumar Pattnaik** **Explanation: (8M)** **Hidden and exposed terminal problems in infrastructure less Network: (4M)** • Consider three mobile phones A,B, C.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. • A starts sending to B, C does not receive this transmission. • C also wants to send something to B and senses the medium. The medium appears to be free, the carrier sense fails. C also starts sending causing a collision at B. • But A cannot detect this collision at B and continues with its transmission. A is **hidden** for C and vice versa. • While hidden terminals may cause collisions, the next effect only causes unnecessary delay. Now consider the situation that B sends something to A and wants to transmit data to some other mobile phone outside the interference ranges of A and B. C senses the carrier and detects that the carrier is busy (B'ssignal). • C postpones its transmission until it detects the medium as being idle again. But as A is outside the interference range of C, waiting is not necessary. Causing a 'collision' at B

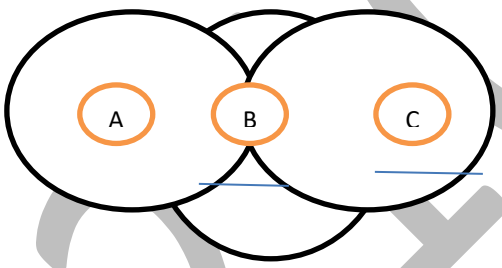
does not matter because the collision is too weak to propagate to A.

- In this situation, C is **exposed** to B.



Near and Far terminals: (4m)

- A and B are both sending with the same transmission power. As the signal strength decreases proportionally to the square of the distance, B's signal drowns out A's signal. As a result, C cannot receive A's transmission.
- C as being an arbiter for sending rights (e.g., C acts as a base station coordinating media access). In this case, terminal B would already drown out terminal A on the physical layer. C in return would have no chance of applying a fair scheme as it would only hear B.



- The **near/far effect** is a severe problem of wireless networks using CDM. All signals should arrive at the receiver with more or less the same strength.
- Even if the senders were separated by code, the closest one would simply drown out the others.
- Precise power control is needed to receive all senders with the same strength at a receiver. For example, the UMTS system adapts power 1,500 times per second.

Diagram (5M)

6 **Differentiate between FDMA, TDMA, and CDMA. (13M)** BTL 2

Answer: **Page: 56-59 - Prasant Kumar Pattnaik**
Explanation(13M)

FDMA	**TDMA**	**CDMA**
Frequency Division Multiple Access or FDMA is an access technology that is used by radio systems to share the radio spectrum. The terminology "multiple access" implies the sharing of the resource amongst users, and the "frequency division" describes how the	Time division multiple access (TDMA) is a channel access method for shared medium (usually radio) networks.	CDMA is a form of "spread-spectrum" signaling, since the modulated coded signal has a much higher bandwidth than the data being communicated.

	sharing is done: by allocating users with different carrier frequencies of the radio spectrum.		
	Frequency limited	Is Bandlimited system	Power limited system
	Single frequency is used for single call	Multiple frequencies are used for multiple calls	Single frequency is used for multiple calls
	Filtering in the frequency domain.	Synchronization in time domain	Code plus special receivers.
	Cell Capacity is limited.	Cell Capacity is limited.	No absolute limit on channel capacity but it is an interference limited system
	Simple, established, robust	Established fully digital, flexible	Flexible, less frequency planning, soft handover
	Inflexible, frequencies are a scace resources.	Guard space needed (multipath propagation) Synchronization needed.	Complex receivers need more powerful control for senders.
	Transmission scheme is Continuous	Transmission scheme is Discontinuous	Transmission scheme is Discontinuous

PART * C

1 **Explain the distinguishing features of various wireless network generations. (15M) (NOV/DEC 2016)** BTL 2

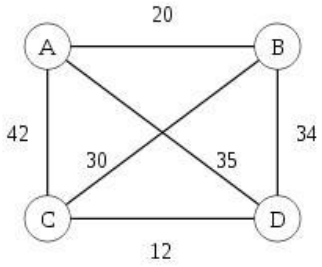
Answer: **Page: 17-19- Prasant Kumar Pattnaik**

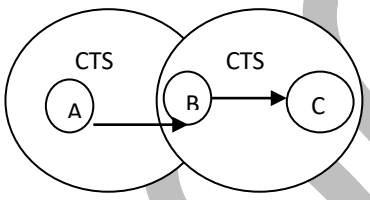
Explanation (15M)

Generation	Period of commercial use	Features	Standards	Data speed
1G	70s to 90s	Analog transmissions, primarly usage restricted to voice communication	NMT,AMPS, TACS	No direct Support
2g	90s to 2000	Digital transmissions, improved performance by letting multiple users share a single channel	GSM	9.6Kps
2.5G	2001-2005	Enhanced multimedia and streaming video, web browsing	GPRS	28kps or higher
3G	2005-2015	Enhanced multimedia and streaming video capabilities	UMTS, HSPDA, EDGE, W-CDMA	384 kps or higher
4G	2010- present	Support interactive multimedia, voice, video, wireless internet and other broadband services	LTE, WIMAX	100 mbps or higher

2 **Classify the different categories of MAC protocols. Identify the situations under which protocols from one category would be preferable over the other categories. Explain the**

	working of a reservation-based MAC protocols. **(15M)** BTL 4 **(MAY/JUNE 2016)** **Answer**: **Page: 61-63- Prasant Kumar Pattnaik** **Explanation (10M)** They are classified into • Fixed assignment schemes • Random assignments schemes • Demand – based schemes **Random Assignment Schemes: (5M)** ALOHA Slotted ALOHA CSMA CSMA/CD CSMA/CA **Reservation- based schemes: (5M)** A basic form of the reservation scheme is the RTS/CTS scheme. In an RTS/CTS scheme, a sender transmits an RTS (Ready to Send) packet to the receiver before the actual data transmission. **MACA** MACA - Multiple Access Collision Avoidance. MACA solves - hidden/exposed terminal regulating - transmitter power. **Diagram (5M)**
3	**Differentiate infrastructure-based networks and infrastructure-less networks with the help of suitable schematic diagrams. (15M)** BTL 4 **Answer**: **Page: 63-65 - Prasant Kumar Pattnaik** **Explanation : (10M)** Infrastructure less wireless network - network of mobile nodes without having any central controller. Compared to ad-hoc wireless networks - infrastructure offers advantage of scale, centralized security management, and improved reach. Wireless devices can connect to resources on a wired LAN - which is common business settings - more access points can be added - improve congestion and broaden the reach of the network. **Diagram (5M)**





Subject Code: CS 8601 **Year / Sem : III / 6**
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UNIT II MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER

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

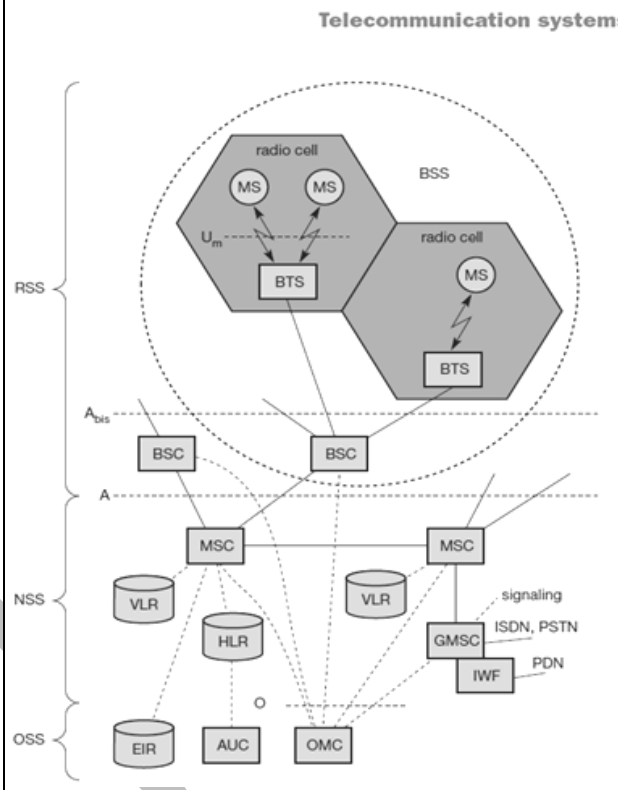
PART * A

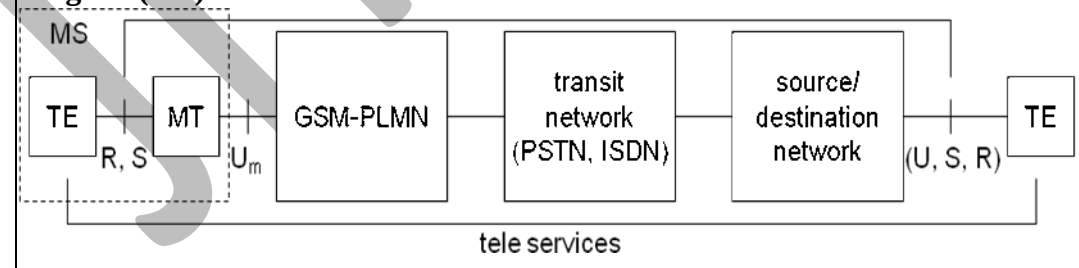
1	**List the features of Mobile IP.** BTL 1 • Transparency • Compatibility • Security • Efficiency and scalability
2	**What are the four types of handover available in GSM?** BTL 1 • Intra cell Handover • Inter cell Intra BSC Handover • Inter BSC Intra MSC handover • Inter MSC Handover
3	**How do I - TCP isolate problems on the wireless link?** BTL 3 **I -TCP isolate problems on the wireless link:** • I. TCP splits the connection into two parts .a wired / fixed and a wireless / mobile part. • I - TCP isolate problems on the wireless link from the fixed networks.
4	**List advantages of mobile TCP.** BTL 1 • It maintains the TCP end .to .end semantics. The SH does not sent any ACK itself but forwards the ACKs from the MH. • If the MH is disconnected, it avoids useless retransmissions, slow starts or breaking connections by simply shrinking the sender's window to 0. • Since it does not buffer data in the SH as I-TCP does, it is not necessary to forward buffers to a new SH. Lost packets will be automatically retransmitted to the new SH.
5	**List disadvantages of mobile TCP.** BTL 1 As the SH does not act as proxy as in I-TCP, packet loss on the wireless link due to bit errors is propagated to the sender. M-TCP assumes low bit error rates, which is not always a valid assumption. A modified TCP on the wireless link not only requires modification to the MH protocol software but also now new network elements like the bandwidth manager.

6	**Define fast retransmit.** BTL 1 The gap in the packet stream is not due to severe congestion, but a simple packet loss due to a transmission error. The sender can now retransmit the missing packet before the timer expires. This behaviour is called fast retransmit.
7	**Define COA.** BTL 1 **(NOV/DEC 2016)** Care –of address is the address of the current tunnel end point for the Mobile node. It gives us the actual location of the MN from an IP point of view. Can be chosen e.g via DHCP.
8	**What are the types of COA?** BTL 1 • Foreign agent COA • Collacated COA
9	**What are the four messages transmitted in optimized mobile IP?** BTL 1 • Binding request • Binding acknowledgement • Binding update • Binding warning
10	**What are the features of mobile IP?** BTL 1 • Transparency • Compatibility • Security • Efficiency and scalability
11	**What are the key mechanisms used in Mobile IP?** BTL 1 • Discovering the care-of- address • Registering the care-of- address • Tunneling the care-of- address
12	**List the use route optimization.** BTL 1 **(APR/MAY 2017)** • Enable direct notification of the corresponding host • Direct tunneling from the corresponding host to the mobile host • Binding cache maintained at the corresponding host

13	**Illustrate the mechanisms used by DHCP for IP address allocation.** BTL 3 • Automatic allocation • Dynamic allocation • Manual allocation
14	**Define GPRS.** BTL 1 The General Packet Radio Service provides packet mode transfer for applications that exhibit traffic patterns such as frequent transmission of small volumes.
15	**List out the service of GSM.** BTL 1 **(NOV/DEC 2016)** The key advantages of GSM systems to consumers have been higher voice quality and low cost alternatives to making cells, such as the Short Message Service. The advantages for network operator have been the ease of deploying equipments from any vendors that implement the standard. Like other cellular standards, GSM allows network operators to offer roaming services so that subscribers can use their phones on GSM networks all over the world
16	**Why routing in multi hop adhoc networks are complicated?** BTL 1 **(APR/MAY 2017)** Routing is complicated because of frequent topology changes, different capabilities of the nodes, varying propagation characteristics. Further, no control instance can support routing.
17	**What is the basic purpose of DHCP?** BTL 1 **(MAY/JUNE 2016)** • DHCP is mainly used to simplify the installation and maintenance of networked computer • DHCP is a mechanism for configuring nodes, parameters acquired via DHCP are eg., IP address, default gateway, DNS server, subnet mask, etc.
18	**Define Tunneling and Encapsulation.** BTL 1 **(MAY/JUNE 2016)** • Encapsulation: is the mechanism of taking a packet consisting of packet header and data and putting it into the data part of a new packet. • Tunnel: establishes a virtual pipe for data packet between a tunnel entry and a tunnel endpoint.
19	**What are the three types of encapsulation?** BTL 1 • IP - in - IP Encapsulation • Minimal Encapsulation • Generic Routing Encapsulation
20	**State the use of BOOTP Protocol.** BTL 3 **(NOV/DEC 2016)** The Bootstrap Protocol (BOOTP) is a computer networking protocol used in Internet Protocol networks to automatically assign an IP address to network devices from a configuration server. The BOOTP was originally defined in RFC 951.
21	**What is the need for encapsulation?** BTL 1 • To hide the original header information

	• To provide data independence
22	**State the IP datagram structure.** BTL 2 The IP datagram structure. An IP datagram consists of a header part and text part. The header has a 20 bytes fixed part and a variable length optional part. It istransmitted in big endian order.
23	**Define congestion avoidance.** BTL 1 Transmission Control Protocol (TCP) uses a network congestion-avoidance algorithm that includes various aspects of an additive increase/multiplicative decrease (AIMD) scheme, with other schemes such as slow start and congestion window to achieve congestion avoidance.
24	**What is Care of address?** BTL 1 Used in Internet routing, a care-of address (usually referred to as CoA) is a temporary IP address for a mobile device. This allows a home agent to forward messages to the mobile device.
25	**What are the ways to reduce the congestion in a mobile network?** BTL 1 • Network monitoring • Network Segmentation • *Use a Content Delivery Network* • *Reconfigure TCP/IP Setting.*
	PART * B
1	**(i) Discuss improvement in TCP for traditional networks. (6M)** BTL 2 **Answer**: **Page:88-91 - Prasant Kumar Pattnaik** **Explanation (4M)** **Traditional Networks:** • In the wired networks - packet losses are primarily attributable to congestions - built-up the networks - reduce congestion - TCP invokes congestion control mechanisms. • Congestion control - primarily achieved by reducing transmission window - which in turn results in slower data transfer. **Diagram (2M)** **(ii) Describe Mechanism for TCP Improvement. (7M) (MAY/JUNE 2016)** BTL 2 **Explanation (4M)** **Slow Start:** • TCP session is started - starting transmission at a fixed transmission window size-transmission is started at the lowest window size - then doubled after each successful transmission. **Congestion avoidance:** • It starts where slow start stops -once the congestion window reaches the congestion - threshold level. **Fast retransmit/ fast recovery**

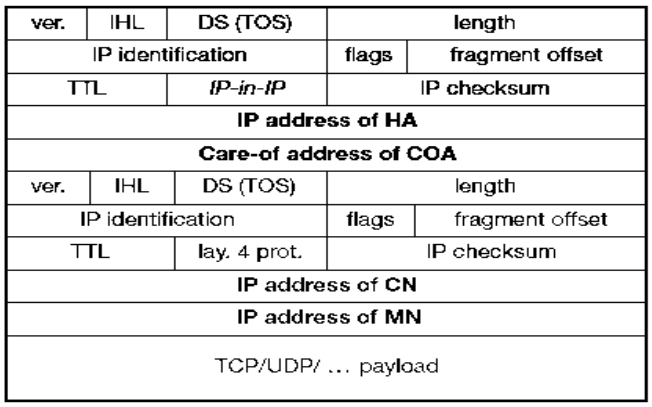
	• A sender initiates a timer after transmitting a packet - sets timeout value (RTO) -RTO is calculated on RTT. **Diagram (3M)**
2	**Explain the GSM system architecture with a neat diagram. (13M) (Nov/dec 2011/ 2015)** BTL 2 **Answer**: **Page: 40-43 - Prasant Kumar Pattnaik** **GSM ARCHITECTURE** The architecture of GSM comes in hierarchy, consisting of many entities, interfaces and subsystems. The GSM system consist of three subsystems namely, • The Radio Subsystems(RSS) • Network and Switching Subsystems(NSS) • Operation Subsystem(OSS) **Diagram(5M)**  **Explanation(8M)** **The components of RSS** • Mobile station • Base Transceiver Station • Base Station Subsystem • Base Station Controller **NETWORK AND SWITCHING SUBSYSTEM:** Network And Switching Subsystem is the heart of GSM. **Functions:**

	• Connects wireless network with standard public network • Performs handover between different BSS • Localization (to locate the mobile station) • Charging, accounting and roaming of users. **Functions** • Traffic monitoring • Status reporting of network entities. • Security management
3	**Describe the services provided by GSM with a neat diagram. (13M)** **(Nov/Dec 2014, 2016)** BTL 2 **Answer**: **Page: 40-42- Prasant Kumar Pattnaik** **Definition(2M)** **GSM: Mobile Services** GSM offers several types of connections voice connections, data connections, short message service, multi-service options (combination of basic services). **Explanation(6M)** **Three service domains** • Bearer Services **(2M)** • Telematic Services **(2M)** • Supplementary Services **(2M)** **Bearer Services** – interface to the physical medium (transparent for example in the case of voice or non transparent for data services) **Telematic Services** – services provided by the system to the end user (e.g., voice, SMS, fax, etc.) **Supplementary Services** – associated with the tele services: call forwarding, redirection, etc. **Diagram(5M)** 
4	**Explain in detail about Mobile IP with a neat sketch. (13M)** BTL 1 **Answer**: **Page: 73-77 - Prasant Kumar Pattnaik** **Definition (2M)** Mobile IP (or MIP) is an Internet Engineering Task Force (IETF) standard communications protocol that is designed to allow mobile device users to move from one network to another while maintaining a permanent IP address.

Explanation (6M)

- Routing
- Specific routes to end-systems
- Changing the IP-address
- Transparency
- Compatibility
- Efficiency and scalability
- Home Agent (HA)
- Foreign Agent (FA)
- Network integration
- Agent Advertisement

Diagram (5M)



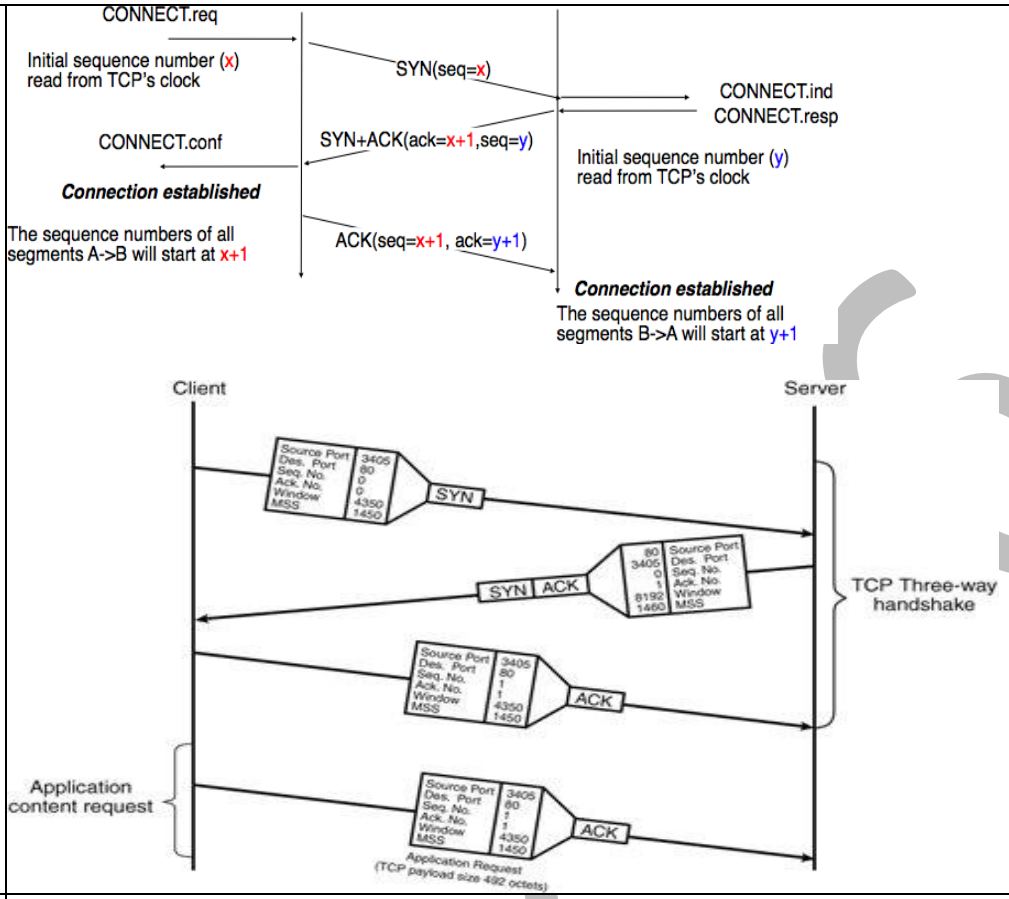
5 **Elaborate TCP operation in detail. Construct the connection transfer of packets from source to destination with a neat diagram (13M)** BTL 6

Answer: **Page: 92-95 - Prasant Kumar Pattnaik**

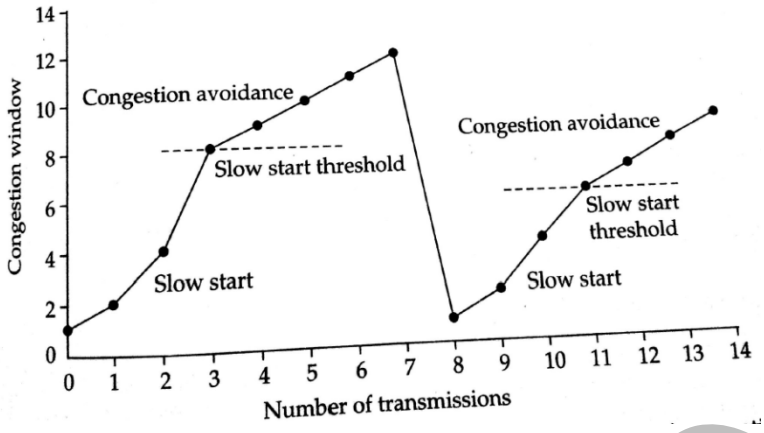
List (3M)

A TCP Connection
Connection Establishment
Three-Way Handshaking:
Data Transfer
Connection Termination

Diagram (10M)



6	**Explain in detail about TCP congestion control algorithms and a graphical representation of congestion and transmission. (13M)** BTL 2 **Answer**: **Page: 101-104 - Prasant Kumar Pattnaik** **Explanation(8M)** **Algorthim List** a. TCP Tahoe **(2M)** b. TCP new Reno **(2M)** c. TCP SACK **(2M)** d. TCP vegas. **(2M)** **Diagram (5M)**



PART-C

1 **Illustrate the comparison of various TCP advantages and disadvantages in Wireless Networking. (15M) (Nov/Dec 2016)** BTL 2

Answer: **Page: 99-110 - Prasant Kumar Pattnaik**

Comparison(15M)

TCP approach	Mechanism Used	Merits	Demerits
Indirect TCP(I-TCP)	Segments the TCP connection into two	- Simple - Isolation of wire and wireless links is possible	- Loss of the TCP semantics -Security Problem
Snooping TCP(S-TCP)	Snooping of data and acknowledgements	-Transparency -MCA interaction	-Inadequate isolation of the wireless links -Security problem
Mobile TCP	The segmented TCP connection can choke the sender through window sizes	-End-to-end segment is maintained -Handles frequent disconnections	-poor isolation Wireless links. -Security problem
Fast retransmission Fast recovery	It avoids slow-start after any roaming	-Simple -More efficient	-Not transparent -Mixed Layers
Freeze- TCP	It freezes the TCP, later it resumes the TCP after reconnection.	-Works even when there are long interruptions	- Changes in TCP. -MAC dependent

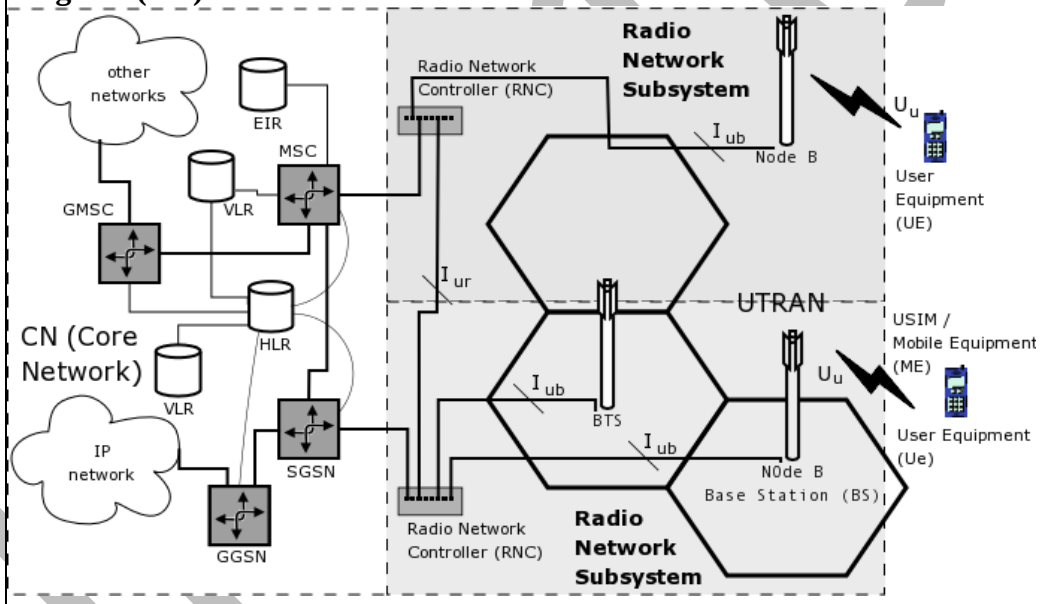
2 **Explain the architecture of GPRS and transmission Protocol of GPRS (13M) (NOV/DEC 2014)** BTL 2

Answer: **Page:44-45 - Prasant Kumar Pattnaik**

Definition(2M)

GPRS stands for General Packet Radio Services. This mechanism is flexible and powerful. This method provides packet mode for data transfer for small volumes of data, to increase the data transfer.

Explanation(8M)

	Expectations: • Should use the existing network resources efficiently. • Should provide the selection of QoS parameters. • Should provide unicast, broadcast, multicast services. **Types of packet transfer services.** • Point to point packet transfer services. • Point to multipoint services. **Diagram(3M)**
3	**Explain System Architecture of UMTS with a neat sketch. (15M) (NOV/DEC 2016)** BTL 1 **Explanation (10M)** **Answer**: **Page: 46-48 - Prasant Kumar Pattnaik** The UTRA network (UTRAN) handles cell level mobility and comprises several radio network subsystems (RNS). **Diagram (5M)**  **UMTS Logical and physical channels:** Dedicated physical data channel (DPDCH) Dedicated physical control channel (DPCCH) Dedicated physical channel (DPCH)

Subject Code: CS 8601 **Year / Sem : III / 6**
Subject Name: Mobile Computing **Subject Handler: Ms. Suganya M**

UNIT III MOBILE TELECOMMUNICATION SYSTEM 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.	
PART * A	
1	**Define Adhoc network.** BTL 1 It is a local area network (LAN) that is built spontaneously as device connects. Instead of relying on a base station to co ordinate the flow of messages to each node in the network, the individual network nodes forward packet to and from each other.
2	**Define MANET.** BTL 1 Mobile Adhoc network without the support of any form of fixed infrastructure such as a base station or an access point. They are set up among the hand held devices of mobile users.
3	**Define VANET.** BTL 1 The Vehicular Ad-Hoc Network, or **VANET**, is a technology that uses moves cars as nodes in a network to create a mobile network. **VANET** turns every participating car into a wireless router or node, allowing cars approximately 100 to 300 meters of each other to connect and, in turn, create a network with a wide range
4	**Which DSDV adds two components to the distance vector algorithm?** BTL 1 Sequence Number and Damping
5	**Which DSR adds two components to the distance vector algorithm?** BTL 1 • Route Discovery • Route Maintenance
6	**Distinguish between MANET and VANET (NOV/DEC 2016)** BTL 2 The main difference between VANET and MANET network is production cost, the VANET production cost is costly when we compare with MANET. The network topology of VANET is frequent, fast, mobility is high because of speed of cars, and other hand the MANET is sluggish and slow. The bandwidth in VANET is higher compare to Mobile Ad-hoc networks. The nodes are moving randomly in MANET but in VANET the nodes are moving regularly.
7	**What is the key difference between MANET and other wireless networks?** BTL 1 • No Fixed Routing/Forwarding Infrastructure • Untrusted environment

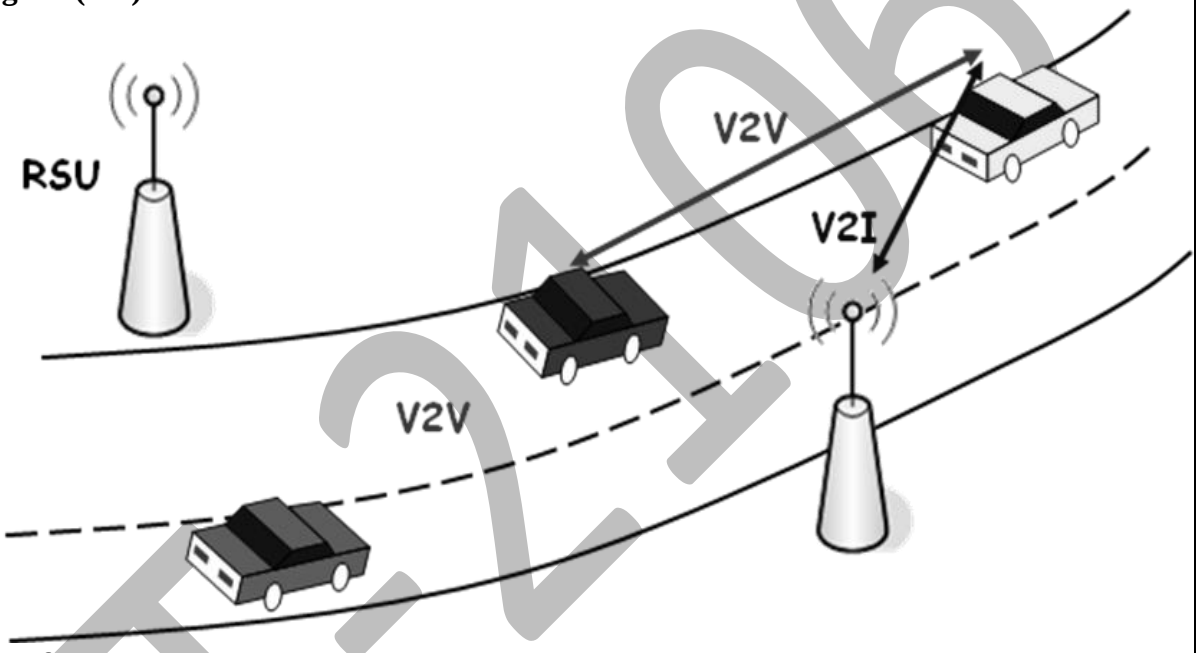
	• No PKI and Online security mechanism.
8	**List the characteristics of MANETs. (MAY/JUNE 2016)** BTL 2 • Lack of fixed infrastructure • Dynamic Topologies • Bandwidth constrained, variable capacity links
9	**Why is Routing in MANET a complex task?** BTL 1 It is difficult to have a global node identifier assigned to every node. In a nutshell, the topology of a network Change dynamically as nodes move way or fail.
10	**What is mesh based protocol?** BTL 1 It establishes a mesh of paths that connects the source and destinations. These are most resilient to link failures as well as to node mobility.
11	**What are the characteristics of secure Ad hoc networks?** BTL 1 • Availability • Confidentiality • Integrity • Authentication
12	**What are the security vulnerabilities of using adhoc network?** BTL 1 • Lack of physical boundary • Low power RF transmissions • Limited computational capabilities • Limited Power supply
13	**What is the difference between AODV and standard distance vector algorithm?** BTL 1 AODV is capable of both unicast and multicast routing. It is a reactive routing protocol, meaning that it establishes a route to a destination only on demand Routers use distance vector based routing protocols to periodically advertise the routes in their routing tables. Routing information exchanged between typical distance vector based routers is unsynchronized and unacknowledged.
14	**What are the features of MANET routing Protocol?** BTL 1 • Capable to identify network topology after changes due to mobility • Topology Maintenance • Scheduling of packet transmission and channel assignment
15	**List example of ON – Demand routing protocol.** BTL 2

	• Dynamic Source Routing (DSR) • Adhoc On- demand distance vector routing (AODV)
16	**What are the types of communications in a network?** BTL 1 The types of communication are: • Unicast • Multicast • Broadcast
17	**State the reason for topology changes.** BTL 3 • The failure of a mobile node due to battery exhaustion, normal failure, or failure due to adverse environmental condition. • Link disconnections may occur due to noise and changes in signal propagation conditions
18	**Define DSR routing.** BTL 1 • The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. • DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. • It is a reactive protocol and all aspects of the protocol operate entirely on-demand basis. • It works on the concept of source routing.
19	**Define ODMR.** BTL 1 On- Demand Multicast routing protocol is a mesh architecture protocol, i.e., it has multiple paths from the sender to the receivers and uses a forwarding group concept. It applies on-demand procedures to dynamically build route and maintain multicast group membership. By maintaining a mesh instead of a tree, the drawbacks of multicast trees in ad hoc networks like frequent tree reconfiguration and non-shortest path in a shared tree are avoided
20	**What are the passive and active attacks in MANET?** BTL 1 **Passive:** Snooping, eavesdropping, Traffic analysis, Monitoring **Active:** Wormhole, black hole, resource consumption, routing attacks
21	**Define the term 'CGSR'.** BTL 4 Cluster-Head Gateway Switch Routing Protocol The Cluster-Head Gateway Switch Routing (CGSR) protocol is a table-driven routing protocol. In a clustering system. each predefined number of nodes are formed into a cluster controlled by a cluster head, which is assigned using a distributed clustering algorithm
22	**What is the concept of RTT.** BTL 3 **(NOV/DEC 2016)**

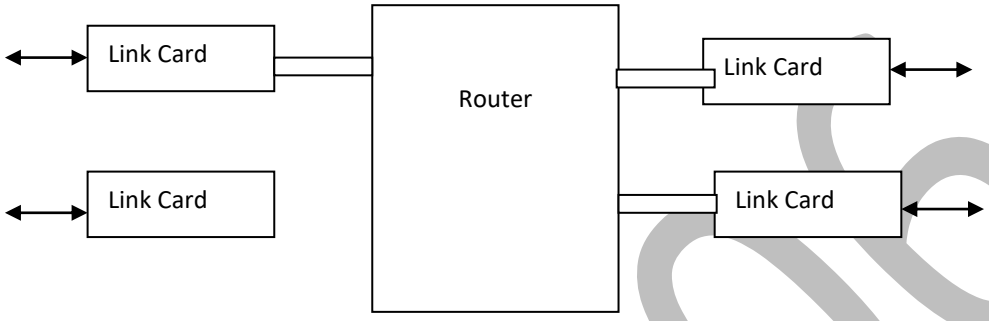
	RTT refers to technology that allows a user to receive data during the actual time that a physical process occurs, known as real time. Real time is measured in milliseconds or microseconds.
23	**Distinguish proactive and reactive protocols.** BTL 2 **(APR/MAY 2017)** Reactive and Proactive Protocols are the routing protocols that are used in mobile Ad hoc networks to send data from the host to the destination. A packet data is sent from source to destination in an Ad hoc network through multiple nodes that are mobile.
24	**What is multicast routing protocol?** BTL 1 A multicast routing protocol is one type of service provider that functions as a client within the framework of the router architecture. A multicast routing protocol manages group membership and controls the path that multicast data takes over the network. Examples of multicast routing protocols include: Protocol Independent Multicast (PIM), Multicast Open Shortest Path First (MOSPF), and Distance Vector Multicast Routing Protocol (DVMRP).
25	**List the disadvantage of DSDV.** BTL 2 A limitation of DSDV is that it provides only one route for a source/destination pair.

PART * B

Q.No	**Questions**
1	**(i)List the characteristics of Mobile Ad hoc Networks (MANETs) (8M)** BTL 2 **Answer**: **Page:130-133 - Prasant Kumar Pattnaik** **Explanation(8M)** • Lack of fixed infrastructure • Dynamic Topologies • Bandwidth constrained, variable capacity links • Energy constrained Operation • Increased Vulnerability **(ii)explain the design issues of MANET. (5M)** BTL 2 **Explanation(5M)** • Network Size and node density • Connectivity • Network topology • User traffic • Operational environment • Energy Constraints

2	**What is VANET? Explain its usage with a neat diagram (13M) (APR/MAY 2017)** BTL 2 **Answer**: **Page: 152-153 - Prasant Kumar Pattnaik** **Explanation(8M)** • Vehicular ad hoc networks (VANET) - special type of MANET - moving automobiles form nodes of the network. • Introduced for vehicles of police - fire brigades and ambulances - safe travelling on road. **Diagram(2M)**  **Uses of VANET (3M)** A VANET can help disseminate geographical information to driver as he continues to drive. **For example**, the driver would be notified of the nearby food malls or petrol refilling stations, map display.
3	**Describe in detail about routing protocols for traditional networks. (13M) (NOV/DEC 2016)** BTL 2 **Answer**: **Page:143-145 - Prasant Kumar Pattnaik** **Explanation(10M)** **Link State Protocols (LSP)** Link denotes the connection of one router to its neighboring router. A neighbor of a router is one with which it can directly communicate without taking a help from any of the intervening routers. **Characteristics** **Router connection to other routers by network interfaces** • The identity of the router originating the message.

- The identities of all its neighbors
- The delay along various links to its neighbors.
- A unique sequence number, which is formed by increasing the count every time the router forms a new link state advertisement



Diagram(3M)

4 **Describe in detail about Manet routing protocols. (MAY/JUNE 2016) (13M)**
BTL 2

Answer: **Page: 146-150 - Prasant Kumar Pattnaik**

Explanation(12M)

Destination Sequenced Distance vector routing protocol (4M)

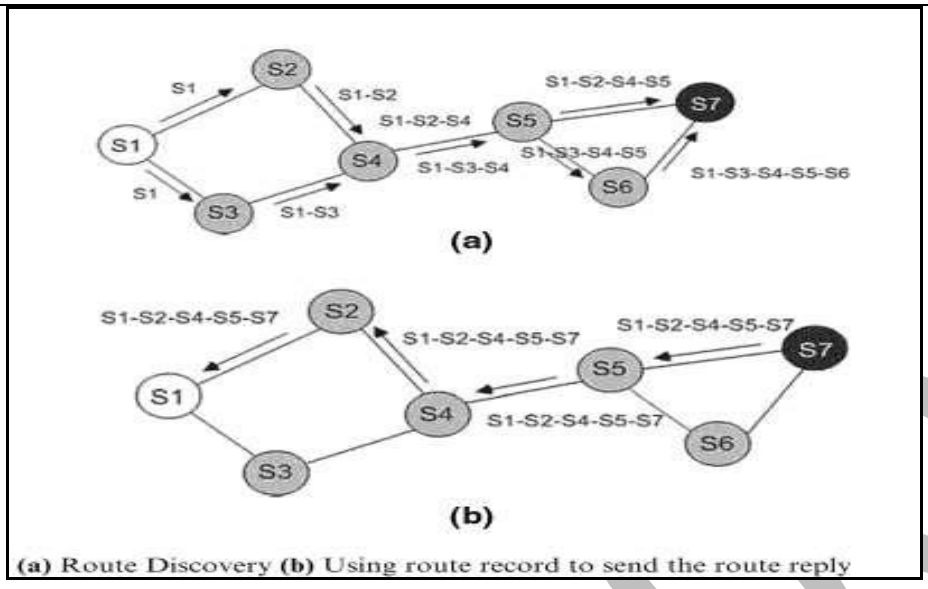
- Table –driven approach to packet routing - extends bellman- ford routing algorithm- improvement made here is avoidance of routing loops through - use of a number sequencing scheme.

Steps in operation of DSDV (4M)

(a) Each router (node) in the network collects route information..
(b) After gathering information - node determines shortest path to destinations based on - gathered information.
(c) Based on gathered information - a new routing table is generated.
(d) Router broadcasts table to its neighbours- on receipt by neighbours - neighbors nodes recomputed - respective routing tables.
(e) Process continues - routing information becomes stable.

Dynamic Source routing protocol (DSR) (4M)

- Dynamic Source Routing protocol (DSR) - simple and efficient routing protocol designed specifically - use in multi-hop wireless ad hoc networks of mobile nodes.
- DSR allows network - completely self-organizing and self-configuring



(a) Route Discovery **(b)** Using route record to send the route reply

Diagram(1M)

5 **What is Routing?State the difference between wired and wireless routing. (13M)**
(Nov/Dec 2015) BTL1

Answer: **Page:138-139 - Prasant Kumar Pattnaik**

Definition(2M)

- **Routing** is the means of discovering paths in computer networks along which information (split up into packets) can be sent.
- Circuit-based networks, such as the voice telephone network, also perform routing, to find paths for telephone calls through the network fabric.

Explanation(6M)

- Routing - directed by **routing tables**, which maintain a record - best routes to various network locations - keep up with packet arrival rate.
- Small networks may involve hand configuration.

Routing Metrics(3M)

i. Hop-Count- It is related to the total number of hops between two nodes.
ii. Queuing delay- This corresponds to the load of the link ie. the traffic going on in the line.

For wireless networks the metrics are

iii. Hop-Count
iv. RTT(Round Trip Time)
v. Packet Pair
vi. ETx (Expected Transmission Count)

Hop-Count:

Advantages (2M)

- Easy to evaluate
- Simple
- Little Overhead

Shortcomings

	It does not consider • Transmit rate • Load • Interference Packet Loss Rate
6	**What are reactive and proactive protocols? Specify its advantages and advantages. (13M) (NOV/DEC 2016)** BTL 1 **Answer**: **Page: 139-141- Prasant Kumar Pattnaik** **Explanation(8M)** **Proactive (Table-driven) protocols:** **Table-driven** routing protocol - each node in routing table maintains information about routes - every other node in network. Tables are periodically updated in face -brandom network topology changes. **Example** of Proactive - destination Sequenced Distance Vector (DSDV) Example of on-demand routing protocols are: • Dynamic source routing(DSR) • Adhoc on- demand distance vector routing (AODV) **Diagram(5M)**
	PART*C
1	**i)Discuss the characteristics of MANET. (8M) (MAY/JUNE 2016)** BTL 3 **(ii)Summarize the applications of MANET. (7M)** BTL 2 **Answer**: **Page: 151-153 - Prasant Kumar Pattnaik** **Characteristics: (8M)** • Lack of fixed infrastructure • Dynamic Topologies • Bandwidth constrained, variable capacity links • Energy constrained Operation • Increased Vulnerability **Application: (7M)** • Tree – based protocol **(4M)** • Mesh based Protocol: **(3M)** Example of this category protocol: On—demand Multicast routing protocol(ODMRP)
2	**Explain the major types of security attacks in a mobile ad hoc network. (15M)** **Answer**: **Page: 129-131- Prasant Kumar Pattnaik**

Explanation (15M)

- DATA traffic attacks
- CONTROL traffic attacks
- Black-Hole
- Cooperative Black-Hole
- Gray-Hole
- Worm-Hole
- HELLO Flood
- Bogus Registration
- Jellyfish
- Man in Middle
- Rushing
- Cache Poisoning
- Blackmail
- Cooperative Blackmail
- Sybil

3	**Explain Distance Vector (DV) protocols in detail with a neat diagram (15M)** BTL 3 **Answer**: **Page: 141-143 - Prasant Kumar Pattnaik** **Definition(2M)** Routers using distance vector protocol do not have knowledge of the entire path that a packet would take to reach its destination • Direction in which a packet should be forwarded. • Its own distance from the destination. **Explanation(8M)** The Two popular distance vector protocols are: (a) **RIP (Routing Information protocol)-** It uses hop count of the destination..It supports cross platform distance vector routing (b) **IGRP (Interior gateway Routing protocol)-** It takes into an account the other

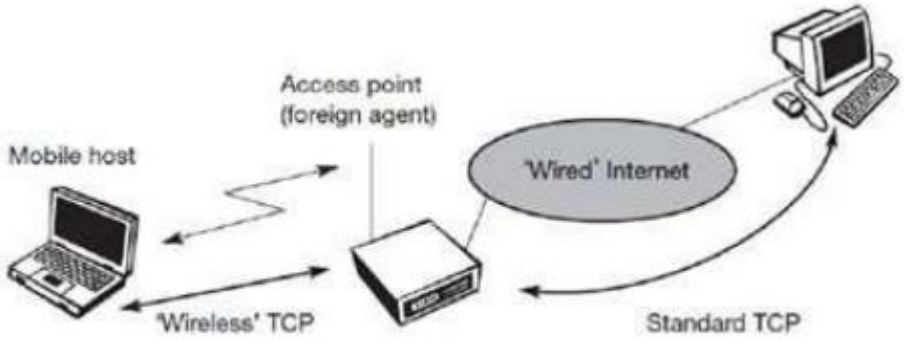
	information such as node delay and available bandwidth. It supports Cisco Systems proprietary distance vector. (c) **Ciscos Enhanced IGRP (EIGRP),** it doesn't not require transmitting updates periodically. Further, the updates are not broadcast and do not contain the full route table. **Diagram (5M)**

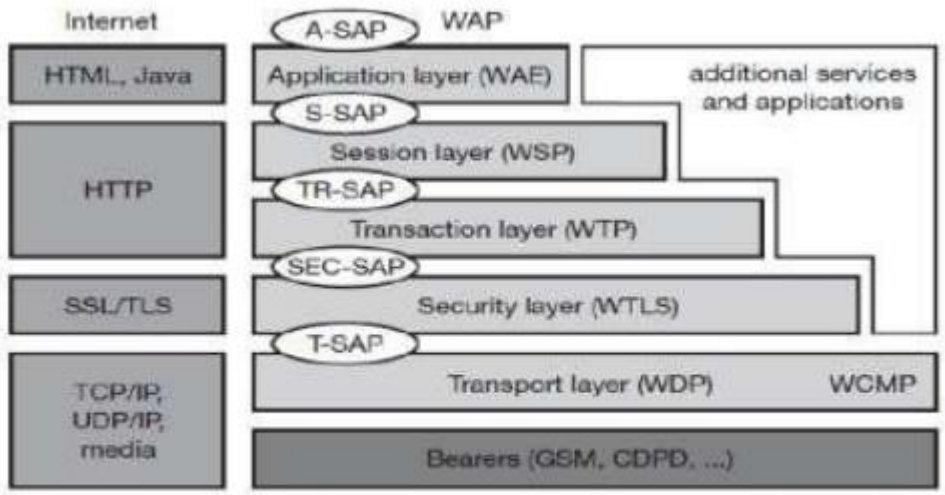
Subject Code: CS 8601 **Year / Sem : III / 6**
Subject Name: Mobile Computing **Subject Handler: Ms. Suganya M**

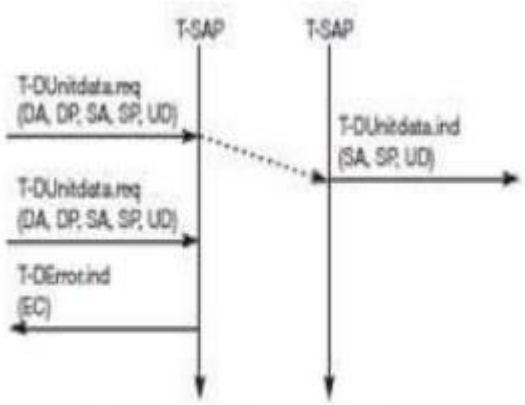
UNIT IV MOBILE AD-HOC NETWORKS Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML	
PART * A	
1	**Define Mobile TCP.** BTL 1 M-TCP (mobile TCP) approach has the same goals as I-TCP and snooping TCP: to prevent the sender window from shrinking if bit errors or disconnection but not congestion cause current problems.
2	**List the advantages of Mobile TCP.** BTL 1 ➢ It maintains the TCP end-to-end semantics. The SH does not send any ACK itself but forwards the ACKs from the MH. ➢ 0 If the MH is disconnected, it avoids useless retransmissions, slow starts or breaking connections by simply shrinking the sender‘s window to 0.Since it does not buffer data in the SH as I-TCP does, it is not necessary to forward buffers to a new SH. Lost packets will be automatically retransmitted to the new SH.
3	**List the disadvantages of Mobile TCP.** BTL 1 ➢ As the SH does not act as proxy as in I-TCP, packet loss on the wireless link due to bit errors is propagated to the sender. M-TCP assumes low bit error rates, which is not always a valid assumption. ➢ 2 A modified TCP on the wireless link not only requires modifications to the MH protocol software but also new network elements like the bandwidth manager.
4	**Comment WAP transaction layer with its wireless transaction protocol.** BTL 1 The WAP transaction layer with its wireless transaction protocol (WTP) offers a lightweight transaction service at the transaction SAP (TR-SAP). This service efficiently provides reliable or unreliable requests and asynchronous transactions as explained in the above section. Tightly coupled to this layer is the next higher layer, if used for connection-oriented service
5	**State Error code.** BTL 1 An error code (EC) is returned indicating the reason for the error to the higher layer. WDP is not allowed to use this primitive to indicate problems with the bearer service.
6	**What is WTLS?** BTL 1 WTLS can provide different levels of security (for privacy, data integrity, and authentication) and has been optimized for low bandwidth, high-delay bearer networks.
7	**How WTP achieves reliability?** BTL 1 WTP achieves reliability using duplicate removal, retransmission, acknowledgements and unique transaction identifiers. No WTP-class requires any connection set-up or tear-down phase. This avoids unnecessary overhead on the communication link.

8	**What are the features of WTP?** BTL 1 A special feature of WTP is its ability to provide a user acknowledgement or, alternatively, an automatic acknowledgement by the WTP entity. If user acknowledgement is required, a WTP user has to confirm every message received by a WTP entity.
9	**State general features needed for content exchange between cooperating clients and servers.** BTL 1 ➢ Session management ➢ Capability negotiation ➢ Content encoding
10	**What are the ideas of Wireless Application Environment?** BTL 1 The main idea behind the wireless application environment (WAE) is to create a general-purpose application environment based mainly on existing technologies and philosophies of the world wide web. This environment should allow service providers, software manufacturers, or hardware vendors to integrate their applications so they can reach a wide variety of different wireless platforms in an efficient way.
11	**Define WTA.** BTL 1 WTA is a collection of telephony specific extensions for call and feature control mechanisms, merging data networks and voice networks.
12	**List the basic features of WML.** BTL 2 ➢ Text and images ➢ User interaction ➢ Navigation ➢ Context management
13	**What is WAE?** BTL 1 Wireless Application Environment, or WAE, provides an architecture for communication between wireless devices and Web servers. ... That Web server responds with an HTML page, which is also sent via HTTP. Because all browsers speak HTTP and both client and server speak the same protocol, they can communicate directly.
14	**What are the capabilities not supported by WML?** BTL 1 ➢ WMLScript offers several capabilities not supported by WML: ➢ Validity check of user input ➢ Access to device facilities ➢ Local user interaction ➢ Extensions to the device software
15	**What are the six libraries in WML Script?** BTL 1 ➢ Lang

	➢ Float ➢ String ➢ URL
16	**What are the wide range of wireless devices?** BTL 1 The forum is embracing and extending existing standards and technologies of the internet wherever possible and is creating a framework for the development of contents and applications that scale across a very wide range of wireless bearer networks and wireless device types. ➢ Interoperable ➢ Scalable ➢ Efficient
17	**State WML Script.** BTL 2 WMLScript complements to WML and provides a general scripting capability in the WAP architecture (WAP Forum, 2000h). While all WML content is static (after loading on the client)
18	**What is Validity Check?** BTL 1 Validity check of user input, before user input is sent to a server, WMLScript can check the validity and save bandwidth and latency in case of an error. Otherwise, the server has to perform all the checks, which always includes at least one round-trip if problems occur.
19	**List DHCP Features.** BTL 2 ➢ DHCP supporting the acquisition of care-of-address for mobile nodes ➢ A DHCP server should located in the subnet of the access point of the mobile note. ➢ DHCP relay should provide forwarding of the Messages. ➢ RFC 3118 specifies authentication for DHCP messages which id needed to protect mobile nodes from malicious DHCP servers.
20	**What is Mobile Adhoc Routing?** BTL 1 ➢ In wireless networks using an infrastructure cells have been defines. within a cell the base station can reach all mobile nodes. ➢ In -hoc networks each node must be able to forward data for other nodes. At a certain time t1 the network topology consists of five nodes N1 to N5. ➢ Nodes are connected depending upon the current transmission characteristics between them. In this network N4 can receive N1 over a good link.
21	**Define Multicast Routing.** BTL 1 Multicast IP Routing protocols are used to distribute data (for example, audio/video streaming broadcasts) to multiple recipients. Using multicast, a source can send a single copy of data to a single multicast address, which is then distributed to an entire group of recipients.
22	**What is Multicast Group Membership Discovery?** BTL 1 A protocol is used by receiving hosts to advertise their group membership to a local multicast

	router, enabling them to join and leave multicast groups. The main Multicast Group Membership Discovery protocols are Internet Group Management Protocol (IGMP) for IPv4 and Multicast Listener Discovery (MLD) for IPv6.
23	**State Slow Start.** BTL 2 TCP s reaction to a missing acknowledgement is quite drastic but it is necessary to get rid of congestion quickly. The behavior shows after the detection of congestion is called Slow start. The sender always calculates a Congestion window for a receiver.
24	**Comment Round Trip Time (RIT).** BTL 2 This scheme doubles the congestion window every time the acknowledgements come back which takes one Round Trip Time (RIT).This is called the exponential growth of the congestion window in the slow start mechanism.
25	**What is Congestion Threshold?** BTL 1 It is too dangerous to double the congestion window each time because the steps might become too large. The exponential growth stops at the Congestion Threshold.The congestion window reaches the congestion threshold further increase of the transmission rate is only linear by adding 1 to the congestion window each time the acknowledgements come back.
	PART * B
1	**What is Mobile TCP? Explain in detail about Mobile TCP.Mention its advantages. (13M)** BTL 3 **Answer**: **Page:170-173 - Prasant Kumar Pattnaik** The M-TCP (mobile TCP)1 approach - same goals as I-TCP and snooping TCP: to prevent the sender window from shrinking - if bit errors or disconnection but not congestion cause current problems. M-TCP- improve overall throughput, to lower the delay, to maintain end-to-end semantics of TCP - provide a more efficient handover.  **Fig 4.1 Indirect TCP segments a TCP Connection into two parts** **Advantages:** 1. As the SH does not act as proxy as in I-TCP, packet loss on the wireless link due to

	bit errors is propagated to the sender. M-TCP assumes low bit error rates, which is not always a valid assumption. 2. A modified TCP on the wireless link not only requires modifications to the MH protocol software but also new network elements like the bandwidth manager.
2	**Explain in detail about WAP Architecture with a neat sketch. (13M)** BTL 3 **Answer**: **Page:129-131 - Prasant Kumar Pattnaik** WAP does not specify bearer services, but uses existing data services and will integrate further services. Examples are message services, such as short message service (SMS) of GSM, circuit-switched data, such as high-speed circuit switched data (HSCSD) in GSM, or packet switched data, such as general packet radio service (GPRS) in GSM. Many other bearers are supported, such as CDPD, IS-136, PHS. No special interface has been specified between the bearer service and the next higher layer, the transport layer with its wireless datagram protocol (WDP) and the additional wireless control message protocol (WCMP), because the adaptation of these protocols are bearer-specific.  **Fig 4.1 Components and Interface of WAP Architecture**

3	**Outline Wireless Datagram Protocol with a neat diagram. (13M)** BTL 3 **Answer**: **Page:111-115 - Prasant Kumar Pattnaik** The Wireless Datagram Protocol (WDP) operates on top of many different bearer services capable of carrying data. At the T-SAP WDP offers a consistent datagram transport service independent of the underlying bearer. To offer this consistent service, the adaptation needed in the transport layer can differ depending on the services of the bearer. The closer the bearer service is to IP, the smaller the adaptation can be. If the bearer already offers IP services, UDP is used as WDP. WDP offers more or less the same services as UDP. WDP offers source and destination port numbers used for multiplexing and demultiplexing of data respectively. The service primitive to send a datagram is TDUnitdata.req with the destination address (DA), destination port (DP), Source address (SA), source port (SP), and user data (UD) as mandatory parameters  **Fig 4.3 WAP Service Primitives**
4	**What is WLTS ?. Brief in detail about WLTS with a outline sketch. (13M)** BTL 3 **Answer**: **Page:177-180 - Prasant Kumar Pattnaik** If requested by an application, a security service, the wireless transport layer security (WTLS), can be integrated into the WAP architecture on top of WDP as specified in (WAP Forum, 2000c). WTLS can provide different levels of security (for privacy, data integrity, and authentication) and has been optimized for low bandwidth, high-delay bearer networks.

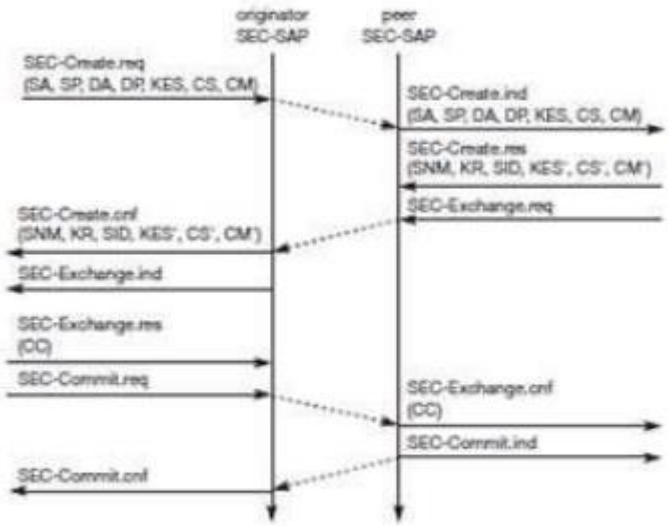


Fig 4.4 WTLS establishing a Secure Session

5 **Describe in detail about Wireless Transaction Protocol. Give a neat sketch. (13M)** BTL 3
Answer: **Page:189-193 - Prasant Kumar Pattnaik**

WTP has been designed to run on very thin clients, such as mobile phones.
WTP offers several advantages to higher layers, including an improved reliability over datagram services, improved efficiency over connection-oriented services, and support for transaction-oriented services such as web browsing.

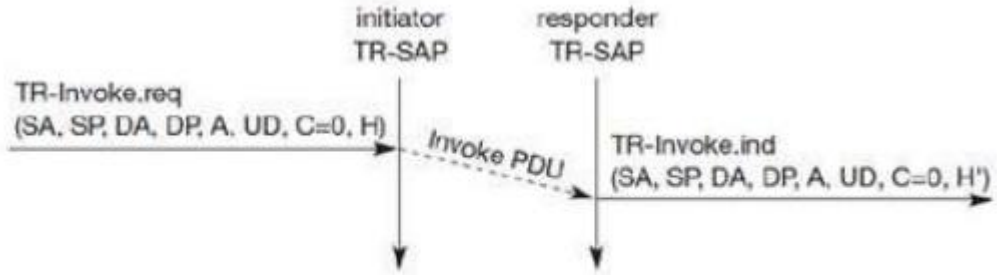
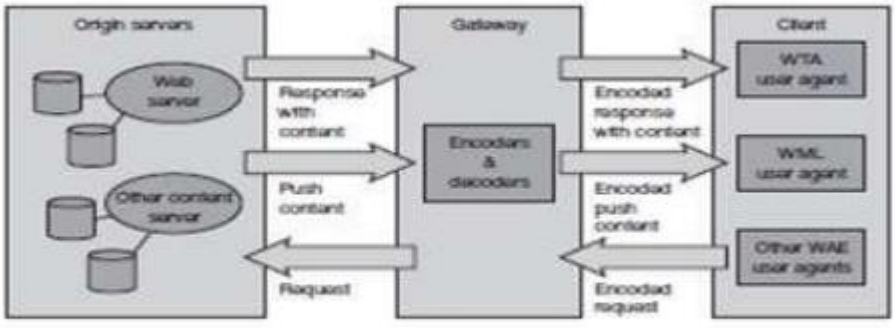


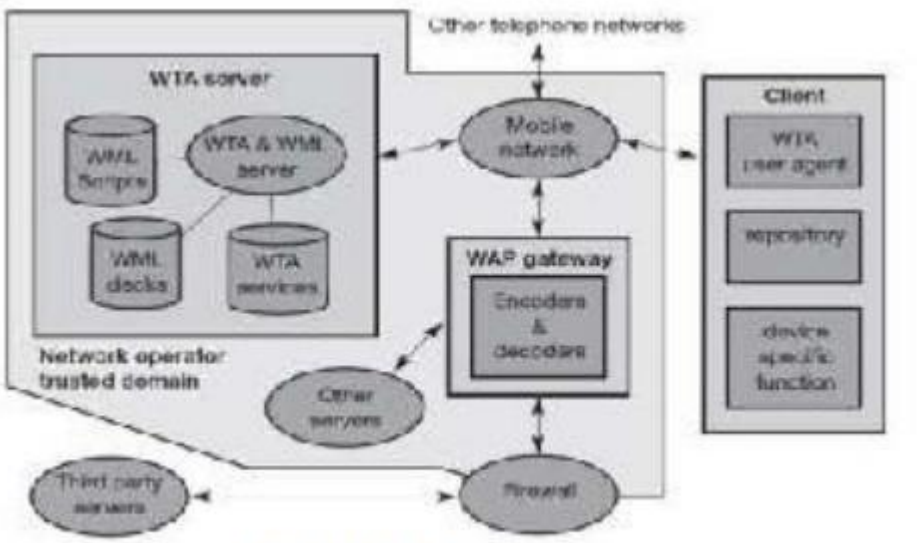
Fig 4.6 Basic Transaction , WTP Class 0

WTP class 1 Class 1 offers a reliable transaction service but without a result message. Again, the initiator sends an invoke PDU after a TR-Invoke.req from a higher layer.

6 **List the features of Wireless Session Protocol. Explain in detail. (13M)** BTL 3
Answer: **Page:182-183 - Prasant Kumar Pattnaik**

Session management:
WSP introduces sessions that can be established from a client to a server and may be long lived. Sessions can also be released in an orderly manner.
Capability negotiation:

	Clients and servers can agree upon a common level of protocol functionality during session establishment. **Content encoding:** WSP also defines the efficient binary encoding for the content it transfers. WSP offers content typing and composite objects, as explained for web browsing. **HTTP/1.1 functionality:** WSP/B supports the functions HTTP/1.1 offers, such as extensible request/reply methods, composite objects, and content type negotiation. **Exchange of session headers:** Client and server can exchange request/reply headers that remain constant over the lifetime of the session. **Push and pull data transfer:** Pulling data from a server is the traditional mechanism of the web. This is also supported by WSP/B using the request/response mechanism from HTTP/1.1. **Asynchronous requests:** Optionally, WSP/B supports a client that can send multiple requests to a server simultaneously.
	PART-C
1	**Describe the main idea behind the Wireless Application Environment(WAE). (13M)** BTL 3 **Answer**: **Page:212-215 - Prasant Kumar Pattnaik** The main idea behind the wireless application environment (WAE) is to create a general-purpose application environment based mainly on existing technologies and philosophies of the world wide web. This environment should allow service providers, software manufacturers, or hardware vendors to integrate their applications so they can reach a wide variety of different wireless platforms in an efficient way. HTML, JavaScript, and the handheld device markup language HDML form the basis of the wireless markup language (WML) and the scripting language WML script.  **Fig 4.10 WAE Logical Model**
2	**Draw a neat sketch and explain the WTA Architecture. (13M)** BTL 3 **Answer**: **Page:200-205 - Prasant Kumar Pattnaik** The WTA framework integrates advanced telephony services using a consistent user interface

	(e.g., the WML browser) and allows network operators to increase accessibility for various special services in their network. A network operator can reach more end-devices using WTA because this is integrated in the wireless application environment (WAE) which handles device-specific characteristics and environments. WTA extends the basic WAE application model in several ways: ➢ Content push ➢ Access to telephony functions ➢ Repository for event handlers ➢ Security model  **Fig 4.11 WTA Architecture** ➢
3	**Outline the Wireless Markup Languages with sample code. (13M)** BTL 3 **Answer**: **Page:232-233 - Prasant Kumar Pattnaik** The wireless link will always have only a very limited capacity compared to a wire. Current handheld devices have small displays, limited user input facilities, limited memory, and only low performance computational resources. While the bandwidth argument will remain for many years, it currently seems that the gap between mobile and fixed devices regarding processing power is getting narrower. <?xml version="1.0"?> <!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN" "http://www.wapforum.org/DTD/wml_1.1.xml">

	<wml> <card id="card_one" title="Simple example"> <do type="accept"> <go href="#card_two"/> </do> This is a simple first card! On the next one you can choose ... </card>

Subject Code: CS 8601 **Year / Sem : III / 6**
Subject Name: Mobile Computing **Subject Handler: Ms. Suganya M**

UNIT V MOBILE PLATFORMS AND APPLICATIONS Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce– Structure – Pros & Cons – Mobile Payment System – Security Issues.	
PART * A	
1	**What are the two main responsibilities of OS in a mobile handset?** BTL 1 Managing Resources Providing different interfaces.
2	**What is the advantage of using Microkernel design approach?** BTL 1 It minimizes the size of the kernel code. It is easier to port, extend, and maintain operating system code.
3	**List the Special constraints of mobile OS. (MAY/JUNE 2016)** BTL 2 • Limited memory • Limited Screen Size • Miniature keyboard • Limited processing power
4	**List the Special service requirements of mobile OS.** BTL 2 • Support for specific communication protocols • Support for variety of input mechanisms • Support for IDE • Extensive library support
5	**What is the advantage of E-commerce?** BTL 1 • The benefits of using M-Commerce include customer convenience, cost savings and new business opportunities. • From the customer's perspective, M-Commerce provides the flexibility of anytime, anywhere shopping using just a light weighted device.
6	**What is the Disadvantage of E-commerce?** BTL 1 • Mobile devices do not generally offer graphics or processing power of PC.The users is therefore constrained to use small screen and keyboard and low resolution pictures and videos. It may be difficult to perceive the look and feel of many products from online pictures and videos. • The small screens of mobile devices limit the complexity of applications. For

	example, the menu choice, and txt typing capability are severely constrained. • No Security.
7	**Define mobile payment system.** BTL 1 A mobile payment may be defined as any payment instrument where a mobile device is used to initiate, authorize and confirm an exchange of financial value in return of goods and service."
8	**What are the features of SDK?** BTL 1 • They can run the application on the actual android device or a software emulator on the host machine. • This is achieved by using the android Debug Bridge (ADB) available with SDK
9	**List out Android application components.** BTL 2 • Activity • Content Providers • Service • Broadcast receivers.
10	**What is the advantage of Android?** BTL 1 • It is an Open platform and can be ported on all cell phone. • The android SDK to develop applications is possible on every operating system. • They support robust libraries for media access, communication and data transfer.
11	**What is radio frequency identification?** BTL 1 RFID tag can be attached to a product, animal, or person for the purpose of identification and tracking using radio waves. Some tags can be read from distance that may be several meters away from the reader and beyond the sight of the reader.
12	**List the operating system that is available for sensor nodes.** BTL 2 • Tiny OS • Contiki • Lite OS • Mantis
13	**Give some applications of M-commerce.** BTL 2 • Advertising

<table>
<tr><td></td><td>

- Mobile ticketing
- Loyalty and payment services
- Interactive advertisements.

</td></tr>
<tr><td>14</td><td>What are the two popular types of M-payment schemes? BTL 1

- Bank account Based
- Credit card based
- Micro Payment

</td></tr>
<tr><td>15</td><td>What are the features required by a mobile device to enable mobile e commerce? BTL 1

- Good Internet Connectivity
- Ability to display rich content such as images
- Ability to scan bar codes
- Ability to read RFID tags

</td></tr>
<tr><td>16</td><td>Define POS. (NOV/DEC 2016) BTL 1
A point of sale (POS) is the place where sales are made. On a macro level, a POS may be a mall, a market or a city. On a micro level, retailers consider a POS to be the area where a customer completes a transaction, such as a checkout counter. It is also known as a point of purchase.</td></tr>
<tr><td>17</td><td>Differentiate E- Commerce and M-Commerce. (NOV/DEC 2016) BTL 2
<table>
<tr><td>E-Commerce</td><td>M-Commerce</td></tr>
<tr><td>1. Any kind of commercial transaction that is concluded, over the internet using electronic system is known as e-commerce.</td><td>M-commerce refers to the commercial activities which are transacted with the help of wireless computing devices such as cell phone or laptops.</td></tr>
<tr><td>2.Use of internet is compulsory</td><td>2.Use of internet is not mandatory</td></tr>
</table>
</td></tr>
<tr><td>18</td><td>What is Mobile Wallet? BTL 1
A user may have a number of ATM card or credit card. The mobile wallet helps to keep these under the umbrella of a single wallet and can make payments whenever necessary. A few example of mobile wallet are paypal, google wallet, Paytm,etc.</td></tr>
<tr><td>19</td><td>What is mChek? BTL 1
It is a new payment system that links a debit or credit card, or a bank account, to a mobile phone, allowing one to make payments from the mobile phone.</td></tr>
<tr><td>20</td><td>List the disadvantage of M-Commerce? (APR/MAY 2017) BTL 2</td></tr>
</table>

	Mobile device do not generally offer graphics or processing power of a PC. The small screens of mobile devices limit the complexity of applications. Security.
21	**What is microkernel operating system?** BTL 1 A microkernel is a piece of software or even code that contains the near-minimum amount of functions and features required to implement an operating system.
22	**Analyze the features of windows iPhone.** BTL 3 • Supports iOS 2, iOS 3, iOS 4 and iOS 5 devices • Multi-platform (Java based) product, supported on Linux, Windows and Mac • Fast, powerful search across device including regular expressions • Integrated mapping supports visualisation of geo-tagged information, including google maps searches, photos, and cell-sites and wifi locations observed by the device (the infamous "locationd" data)
23	**Describe UIQ interface.** BTL 3 An interface is a set of commands or menus through which a user communicates with a program. A command-driven interface is one in which you enter commands. A menu-driven interface is one in which you select command choices from various menus displayed on the screen.
24	**What are the elements of Android software stack? (APR/MAY 2017)** BTL 1 • linux kernel • native libraries (middleware), • Android Runtime • Application Framework • Applications
25	**State the drawbacks of Symbian OS.** BTL 2 The reason for problems could have been in the software architecture. The basic Symbian OS was pretty well optimized to run on even pretty low power CPUs (uses less processing power than Linux or iOS for the same tasks), but to accomplish this Symbian went its own way with just about everything.
	PART * B
1	**i)What are the advantages of M commerce?** **(7M)** BTL 2 **Answer**: **Page: 223-224 - Prasant Kumar Pattnaik** **Advantages:** • For business organization- benefits of using M-Commerce - include customer convenience - cost savings - new business opportunities. • customer's perspective - M-Commerce provides - flexibility of anytime, anywhere shopping - light weighted device- customer can save substantial time compared to

	visiting several stores - identifying - right product at the lowest price. • Mobile devices - highly personalized - providing an additional level of convenience to customers. For example - a repeat order for some items - placed just at touch of a button. Application software downloaded for specific m-commerce vendor - store many customer specific information - help to effortlessly place orders. **ii) What are the disadvantages of M commerce? (6M)** BTL 2 **Disadvantages:** • Mobile devices - generally offer graphics or processing power of a PC- users are constrained to use small screen - keyboard and low resolution pictures videos - difficult to perceive - look and feel of many products from online pictures and videos. • Small screens of mobile devices limit - complexity of applications. For example- menu choice- text typing capability- severely constrained. • Network impose several types of restrictions -for example, the available bandwidth is severely restricted - international calls - SMS be prohibitively expensive. • disadvantage is security -unless a customer is extremely careful- may fall prey to various types of frauds - may get billed for items he did not purchase.
2	**Explain in detail the structure of Mobile Commerce. (13M)** BTL 2 **Answer**: **Page: 223-226 - Prasant Kumar Pattnaik** **Definition(2M)** • In mobile commerce, a content provider implements an application by providing two sets of programs: Client side and server-side. • The client side programs run on the micro browsers installed on the users mobile devices. • These server side programs, performing database access and computations, reside on the host computer (servers). **Explanation(6M)** • Mobile Devices • Network • Host Computers Major components:

	• Web servers. • Database servers • Application Program **Diagram(5M)**
3	**What are the special constraints of Mobile O/S? Illustarte with examples. (13 M) (NOV /DEC 2016)** BTL 3 **Answer**: **Page:230-231 - Prasant Kumar Pattnaik** **Definition(2M)** The operating system for a mobile device needs to function in the presence of many times of constraints which are not present in the traditional computer. As an example of such a constraint, consider the fact that a mobile device is powered by severely limited energy stored in a tiny battery. **Explanation(6M)** • Limited Memory • Limited Screen Size • Miniature Keyboard • Limited Processing Power • Limited Battery Power • Limited and fluctuating bandwidth of the wireless medium • Real Time data streaming **Diagram(5M)**
4	**Describe in detail about Mobile payment systems**. **(13M)** BTL 3 **Answer**: **Page: 231-232 - Prasant Kumar Pattnaik** **Definition(2M)** **Mobile Payment Systems** "Mobile payments are a natural evolution of E-payment schemes. A mobile payment may be defined as any payment instrument where a mobile device is used to initiate, authorize and confirm an exchange of financial value in return of goods and service." **Explanation(10M)** **<u>Mobile Payment Schemes</u>** • Bank account based • Credit card based

	• Micropayment **Desirable properties of a Mobile Payment System:** • Easy to use: • The M-payment request must be easy for the customer to use **Mobile Payment solution:** • SMS based payment: • POS based payment • Bar code based payment • Mobile Wallet **Process of Mobile Payment** **Diagram(1M)**
5	**Describe in detail about Commercial Mobile operating systems in detail. (13M) (APR/MAY 2017)** BTL 3 **Answer**: **Page:232-233 - Prasant Kumar Pattnaik** **Explanation(8M)** • The Graphic / Window / Event manager (GWE) component handles all input and output • Previous a virtual memory management • Supports security through provision of a cryptographic library. • Application development similar to that in Win32 environment. advantages since many programmers have knowledge of Win 32 based application development **Android (5M)** • Android software stack • Application layer • Application framework • Libraries and runtime • Kernel
6	**Discuss the applications of M-Commerce with a neat sketch. (13M) (NOV/DEC 2016)** BTL 3 **Answer**: **Page: 223-224- Prasant Kumar Pattnaik** **Explanation(8M)** • Advertising

	• Comparison Shopping • Information about a product • Mobile ticketing • Catalogue Shopping **Diagram(5M)**
	PART * C
1	**What is RFID? Briefly explain the principle and its working. (15M) (MAY/JUNE 2016)** BTL 2 **Answer**: **Page:209-211 - Prasant Kumar Pattnaik** **Definition (2M)** Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically-stored information. The tags contain electronically-stored information. **Explanation(10M)** **RFID Tag** An RFID tag is an electronic device **RFID Reader** An RFID reader combines the functions of radio transmitter, receiver and data interface. **Data Retrieval** A computer picks up the data sent to it by the RFID reader. **Uses** Many companies use RFID tags to track the flow of goods through warehousing, distribution and retail. **Diagram(3M)**
2	**What do you understand by the mobile payment system? Briefly explain an application where mobile payment may be useful. (15M) (NOV/DEC 2016)** BTL 2 **Answer**: **Page: 231-235- Prasant Kumar Pattnaik** **Definition(2M)** **Mobile Payment Systems:** "Mobile payments are a natural evolution of E-payment schemes. A mobile payment

	may be defined as any payment instrument where a mobile device is used to initiate, authorize and confirm an exchange of financial value in return of goods and service." **Explanation(10M)** **Mobile Payment Schemes** • Bank account based • Credit card based • Micropayment **Desirable properties of a Mobile Payment System:** • Easy to use: • The M-payment request must be easy for the customer to use **Mobile Payment solution:** SMS based payment: POS based payment Bar code based payment Mobile Wallet **Process of Mobile Payment** **Diagram(3M)**
3	**Explain the different mobile payment schemes and security issues. (15M) (MAY/JUNE 2016)** BTL 3 **Answer**: **Page:234-235 - Prasant Kumar Pattnaik** **Explanation(10M)** **Mobile Payment Schemes** • Bank account based • Credit card based • Micropayment Step 1: Customer places order for goods with the trader. Step 2: The trader securely transfer the order to the selected payment service provider over the Internet. Step 3: The customer authenticates with the payment service provided. Step 4: The transaction detail appropriately and securely routes the transaction authorization request through its payment gateway to the selected customer's bank. Step 5: The merchant is informed of the payment status. Step 6: For Successful transaction, the customer's bank transfer the requested amount to the trader's bank account. **Diagram(5M)**