III/IV B.Tech (Regular/Supplementary) DEGREE EXAMINATION
Wireless Networks (14IT602)
Scheme of Evaluation

Time: Three Hours   **Maximum:** 60 Marks

Answer Question No.1 compulsorily. (1X12 = 12 Marks)
Answer ONE question from each unit. (4X12=48 Marks)

1. Answer all questions.   1x12=12M
a. What are location aware services?   (1M)

Ans:

Location awareness refers to devices that can passively or actively determine their **location**. Surveying equipment identifies **location** with respect to a well-known location wireless communications device.

b. What is frequency domain?   (1M)

Ans:

The **frequency domain** refers to the analysis of mathematical functions or signals with respect to **frequency**, rather than time.

c. What is Path Loss?   (1M)

Ans:

Path loss (or **path** attenuation) is the reduction in power density (attenuation) of an electromagnetic wave as it propagates through space.

d. What is the difference between HDB & VDB?   (1M)

Ans:

In the DECT context the databases **home data base (HDB)** and **visitor data base (VDB)** are also located. Both databases support mobility with functions that are similar to those in the HLR and VLR in GSM systems.

e. What are Transparent Bearer Services in GSM?   (1M)

Ans:

Bearer services permits transparent and non-transparent, synchronous or asynchronous data transmission.

f. What are the Functionalities of MAC Layer?   (1M)

Ans:

The **MAC layer** is responsible for moving data packets to and from one Network Interface Card (NIC) to another across a shared channel.

g. What is PPDU? **(1M)**

Ans:

The 802.11 standard refers to this composite frame (the MPDU with an additional PLCP preamble and header) as a PLCP protocol data unit (**PPDU**).

h. What is Traffic Indication Map? **(1M)**
Ans:

Traffic indication map (TIM) is a structure used in 802.11 wireless network management frames. Traffic Indication Map (TIM) - used when stations have enabled power save mode. The TIM is a list of all stations that have undelivered data buffered.

i. What is beacon frame? **(1M)**
Ans:

Beacon frame is one of the management **frames** in IEEE 802.11 based WLANs. It contains all the information about the network.

j. What is congestion window? **(1M)**
Ans:

Congestion Window (cwnd) is a TCP state variable that limits the amount of data the TCP can send into the network before receiving an ACK. The Receiver Window (rwnd) is a variable that advertises the amount of data that the destination side can receive.

k. List any two advantages of M-TCP **(1M)**
Ans:

1. It Maintains semantics
2. It supports disconnection
3. There is no buffer forwarding

l. List three classes of libraries defined by WML. **(1M)**
Ans:

Lang: The Lang library contains functions that directly extend the WMLScript language

URL: This library contains functions that work with absolute and relative URLs.

WMLBrowser: This library gives you access to the WML user agent context (when the WMLScript was called from WML).

UNIT-I

2a) What are the main benefits of a spread spectrum system? How can spreading be achieved? How can DSSS System benefits from multipath propagation?   **6M**

Ans:

What are the main benefits of a spread spectrum system?   **1M**

1. robust against interference
2. inherent security (if the spreading code is unknown, it is very difficult to tap the transmission)

How can spreading be achieved?

The spreading can be achieved by two different ways.

Direct sequence spread spectrum (DSSS):   **2M**

The DSSS system take a user bit stream and perform an (XOR) with a so-called chipping sequence. For each user bit with duration tb, a chip sequence with a smaller duration tc for each chip. Generally the chipping sequence is generated properly it appears as random noise. The bandwidth of the resulting signal is determined by the spreading factor s = tb/tc. That is, the original signal is spreaded by s times.

Frequency Hopping Spread Spectrum (FHSS):   **2M**

The FHSS system splits the total available bandwidth into many channels of smaller bandwidth plus guard spaces between the channels. Transmitter and receiver stay on one of these channels for a certain time and then hop to another channel. The pattern of channel usage is called the hopping sequence. The time spent on a channel with a certain frequency is called the dwell time. FHSS comes in two variants, slow and fast hopping. In the slow hopping, the transmitter uses one frequency for several bit periods. The fast hopping systems, on the other hand, ask the transmitter to change the frequency several times during the transmission of a single bit. The slow hopping systems are typically cheaper and have relaxed tolerances. But they are not as immune to narrowband interference as fast hopping systems.

How can DSSS systems benefit from multi-path propagation?   **1M**

DSSS systems typically use rake receivers that recombine signals travelling along the different paths. Recombination results in a stronger signal compared to the strongest signal only.

2b) Which of the MAC scheme can give hard guarantees related to bandwidth and access Delay.   (Description-6m)   **6M**

Ans: **6M**

Fixed TDMA schemes can give hard guarantees – that's why they are used in classical phone systems (ISDN, SDH, GSM/CSD,.). Also implicit reservations can give guarantees after the reservation succeeded. Furthermore, all centralistic systems, i.e., systems with a base station or access point controlling data transfer, can give guarantees. All non-deterministic schemes, such as CSMA/CA, MACA, cannot give any hard guarantees.

(OR)

3a) What are the main reasons for using cellular systems? How SDM is typically realized and combined with FDM? How does DCA influence the frequencies available in other-Cells? **6M**

Ans:

What are the main reasons for using cellular systems? **4M**

➢ Higher capacity, higher number of the users: cellular systems can reuse spectrum according to certain patterns.
➢ Each cell can support a maximum number of users.
➢ Support user localization and location based services:
➢ Less transmission power needed.
➢ Smaller cells also allow for less transmission power (thus less radiation). The mobile systems can enjoy longer runtime.

How SDM is typically realized and combined with FDM? **1M**

➢ Typically each cell holds a certain number of frequency bands. Neighboring cells are not allowed to use the same frequencies.

How does DCA influence the frequencies available in other-Cells? **1M**

➢ Whether or not DCA depends on the current load. It can react upon sudden increase in traffic by borrowing capacity from other cells. However the "borrowed" frequency must then be blocked in neighboring cells.

3b) What are benefits of reservation schemes? How are collisions avoided during data transmission, why is the probability of collision lower compared to classical Aloha? What are disadvantages of reservation schemes? **6M**

Ans:

What are benefits of reservation schemes? **2M**

➢ After reservation of the medium succeeded no more collisions can occur (if the system is error free).
➢ Reservation schemes can also guarantee bandwidth, delay and maximum jitter. Thus, during the transmission nothing can happen.

How are collisions avoided during data transmission, why is the probability of collision lower compared to classical Aloha? **2M**

➢ Compared to classical Aloha the collision probability is lower because the contention period is kept short compared to the contention-free period where transmission take place.

What are disadvantages of reservation schemes? **2M**

➢ A disadvantage of reservation schemes is the latency for data transmission. Before terminals can start transmission they have to reserve the medium. This wastes time in case of a very lightly loaded medium.
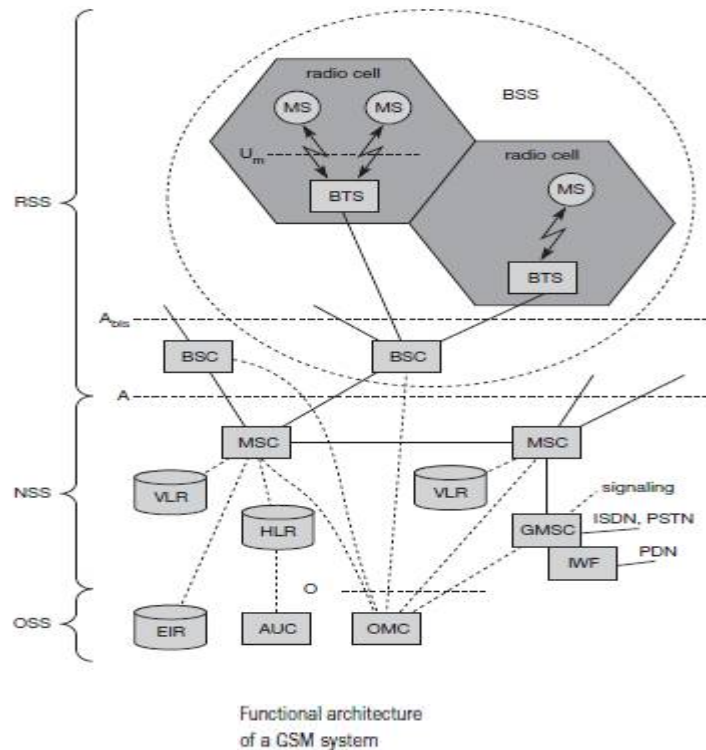
4a) Name the main elements of the GSM system architecture and describe their functions. What are the advantages of specifying not only the radio interface but also all internal interface of the GSM system? **6M**

Ans: (for figure-3m, for Desrciption-3m)

GSM Architecture **3M**

Functional architecture
of a GSM system

The main elements are **2M**

BTS - base station tranciever unit - radio interface for network

BSC - base station controller - manages a cluster of BTS (handoff,radio channel assignment etc.)

MSC - mobile switching center which controls connections/callsetup/handoff etc..

HLR - Home location Register - master database of subscriber info

VLR - Visitor Location Register - local database of subscriber info for all uses in a MSC service
area

EIR - equipment identity register database of valid/invalid equipment

AUC - authentication center - database of encryption info.

What are the advantages of specifying not only the radio interface but also all internal interface of the GSM system? **1M**

The advantages of standardizing the internal interfaces as well as the radio interface is that it allows network service providers the flexibility to use equipment/software from a variety of vendors => interoperability => reduced costs

4b) Name basic applications for satellite communication and describe the trends.   6M

Ans: (Description-6m)   6M

1) The traditional application for satellites is the "big cable in the sky." i.e., satellites interconnect distant locations.
2) Today, this traditional usage for satellites is not dominant anymore. Thousands of fibers through all oceans connect all continents offering more capacity than currently needed.
3) However, satellites are still required for TV/radio distribution and access to telecommunication networks at remote places, places with destroyed infrastructure, hostile environments etc.

(OR)

5a) What are the functions of authentication and encryption in GSM? How is system

Security maintained?   6M

Ans: (Description-4m, How is System security maintained-2m)   4M

➢ The first step is the authentication of the user against the SIM. This is done using a simple PIN. Then, the SIM authenticates itself against the GSM system.
➢ This second authentication is much stronger compared to the PIN. This is because the operator is not really interested in who is using the system as long as it is a valid and paying customer.
➢ Authentication with the system uses a challenge response scheme with a shared secret on the SIM and in the AuC.
➢ Neither the SIM nor the AuC will transmit this secret over the air or reveal it to customers. Encryption only takes places between the MS and the BSS.

How is system Security maintained?   2M

➢ GSM does not provide strong encryption end-to-end or MS to the gateway into the fixed network. System designers decided for over-the-air encryption only as they thought that the system itself is trustworthy.
➢ Thus, authentication of base stations against MSs was neglected, too. This opened ways to fake base stations.

5b) How could location based services and broadcast systems work together?   6M

Ans: (Description-6m)

If the location of a user is known to the system, LBSs may offer individual, location dependent services (next pizzeria, next ATM, cheapest bookstore in close proximity, gaming partners within a certain radius etc.). Depending on the current location, the LBS (Liberia Broadcasting System) may program broadcast disks of broadcast providers for individual users or groups of users. If an LBS discovers a group of people standing in front of a museum, it could trigger a video stream on a DVB device showing pictures from the current exhibition.

6a) What are the basic differences between wireless WANs and WLANs and what are the Common features? Consider mode of operation, administration, frequency, capabilities of nodes, services, national/international regulations   **6M**

Ans: (8 Features 6m)   **6M**

- ➢ coverage (GSM 70km cells, WLAN 100m)
- ➢ data rates (GSM 50 kbit/s, WLAN 50 Mbit/s)
- ➢ quality of service (WWAN voice/data rate, WLAN none/some with HiperLAN2)
- ➢ transmission power (powerful base stations for WWANs, some hundred mW for WLANs)
- ➢ operation (WWAN licensed, WLAN license exempt)
- ➢ administration (WWAN public operators, WLAN private)
- ➢ Frequencies (WWAN many different national frequencies, WLAN almost common international ISM bands).
- ➢ Common characteristics: similar propagation characteristics, similar problems.

6b) What is the basic purpose of DHCP? Name the entities of DHCP.   **6M**

Ans: (Description-6m)

- ➢ DHCP is a mechanism for configuring nodes
- ➢ Parameters acquired via DHCP are, e.g., IP address, default gateway, DNS server, subnet Mask etc.
- ➢ Without DHCP all parameters must be configured manually.
- ➢ A DHCP server provides DHCP information, a relay can forward data into different LANs.

(OR)

7a) Discuss in detail about IEEE 802.11 Protocol Architecture.   **6M**

Ans: (Diagram-2m, Layers and functions-2m, services and access methods-2m)
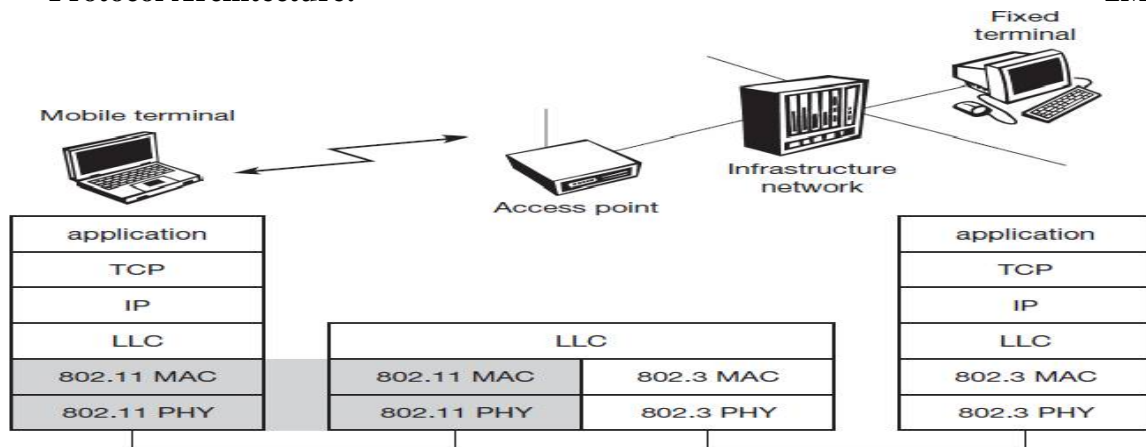   **Protocol Architecture:**   **2M**

Fig: IEEE 802.11 protocol architecture and bridging

MAC
- □ access mechanisms, fragmentation, encryption

MAC Management
- □ synchronization, roaming, MIB, power management

PLCP Physical Layer Convergence Protocol
- □ clear channel assessment signal (carrier sense)

PMD Physical Medium Dependent
- □ modulation, coding

PHY Management
- □ channel selection, MIB

Station Management
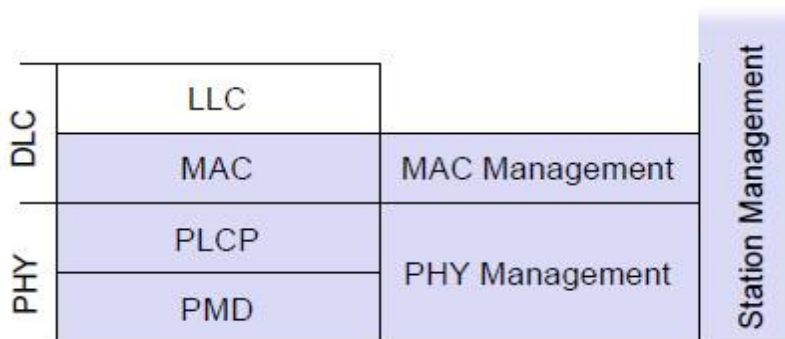- □ coordination of all management functions

DLC	LLC		Station Management
	MAC	MAC Management	
PHY	PLCP	PHY Management	
	PMD		

Fig2:802.11 - Layers and functions   **2M**

Traffic services and Access methods: **2M**

➢ Traffic services

Asynchronous Data Service (mandatory)

  Exchange of data packets based on "best-effort"

  Support of broadcast and multicast

 Time-Bounded Service (optional)

  Implemented using PCF (Point Coordination Function)

➢ Access methods

DFWMAC-DCF CSMA/CA (mandatory)

Collision avoidance via randomized „back-off "mechanism minimum distance between consecutive packets

ACK packet for acknowledgements (not for broadcasts)

 DFWMAC-DCF w/ RTS/CTS (optional)- Distributed Foundation Wireless MAC avoids hidden terminal problem

DFWMAC- PCF (optional) - access point polls terminals according to a list

7b) Show the steps required for a handover from one foreign agent to another foreign agent including layer 2 and layer 3.   6M

Ans: (6 points-6Marks)   6M

➢ Even if you can do a handover with mobile IP, each handover starts on layer 2.

➢ Thus, first the usual procedure of scanning the medium, detecting other base stations, deciding on one of them, (make reservations, if allowed by the network,) reroute data inside the infrastructure network, release resources with the old base station.

- As soon as the registration with the new base station is done, we have to listen for agent advertisements to get a new COA from a new FA, start authentication, and inform the HA about the new address.
- In the meantime, lot of data are sent to the old base station;
- Here, the FA would have to buffer them to avoid a data loss.
- The new FA would inform the old one about the new device, the data transferred during handover is redirected.

UNIT-IV

8a) How and why does I-TCP isolate problems on the wireless link? What are the main drawbacks of this solution?   **6M**

Ans: **(Description-6m)**

I-TCP splits the connection into two parts – a wired/fixed and a wireless/mobile part. This isolates problems on the wireless link from the fixed network. However, this also requires that intermediate systems are able to look into IP packets to split the connection. This prevents the usage of IPsec – end-to-end security and I-TCP (or proxy solutions in general) do not go together.

8b) Discuss in detail about WAP Architecture.   **6M**

Ans: **(Figure-2m, Layers description-4m)**   **2M**
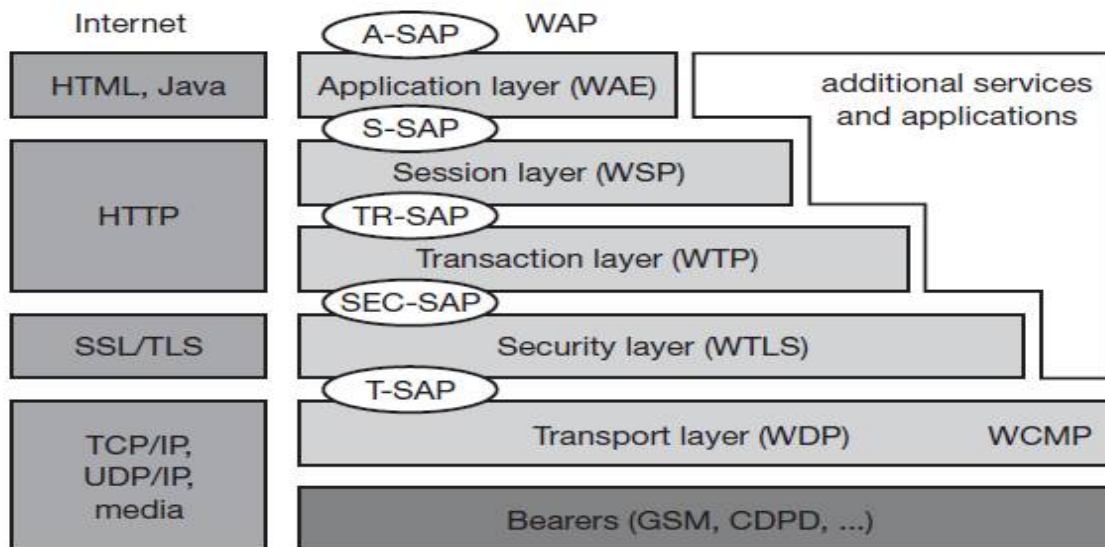
Datagram Protocol (WDP)   **1M**
Goal:
To allow transport, security, and session protocols to operate independent of the underlying bearer (e.g. GSM, CDMA, etc.)
• If bearer already offers IP services UDP is used as WDP, WCMP-provides error handling

Mechanism, messages are destination unreachable, parameter problem, message too big etc.
• Datagram has DA, DP, SA, SP, user data as mandatory parameters

WTLS (Wireless Transport Layer Security)   **1M**
 Goal:
It provides the upper-level layer of WAP with a secure transport service interface that preserves the transport service interface (datagram) below it.
• Security level of WTLS depends on the requirements of the given application
• Privacy, data integrity, authentication
• Takes into consideration the limitations of mobile devices

WTP Services and Protocols:
WTP three classes of service
Class 0: unreliable message transfer
Class 1: reliable message transfer without result message
Class 2: reliable message transfer with exactly one reliable result message

WSP - Wireless Session Protocol   **1M**
• WSP Services
Provides shared state between client and server, optimizes content transfer session management (establish, release, suspend, resume), efficient capability negotiation (SDU size, Max outstanding requests) content encoding
• WSP/B (Browsing)
HTTP/1.1 functionality - but binary encoded exchange of session headers push and pull data transfer asynchronous requests

WAE (Wireless Application environment)   **1M**
• WAE defines basics:
        For WAP user agents
        For WAP gateways.
• WAE contains:
        WML and WMLScript specifications
        Wireless Telephony Application Interface (WTAI)
                                (OR)

9a) Show the interaction of mobile IP with standard TCP. Draw the packet flow host to a mobile host via a foreign agent. Then a handover takes place. What are the following actions of mobile IP and how does TCP react?   **6M**
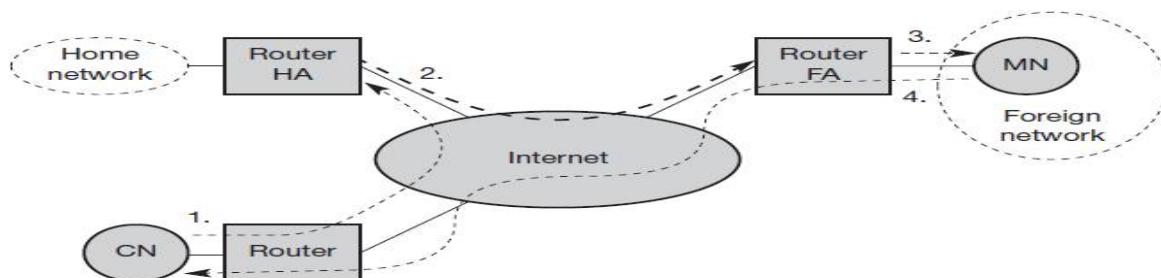**Ans: (Figure -3m, Description- 3m)**

Figure: Packet delivery to and from the mobile node

From the figure 8.2 for the packet flow. TCP does not directly interact with IP as mobile IP keeps mobility transparent. TCP may only experience higher loss rates during handover. Mobile IP handles the handover; old FAs may or may not forward packets. If acknowledgements arrive too late, TCP assumes congestion, goes into congestion avoidance and enters slow-start. However, slow-start is absolutely counterproductive. Sending with the same data rate as before would make sense.

9b) Explain in detail about Wireless Markup Language (WML).   **6M**
Ans: **(Description-3m, Example-3m)**
Wireless Markup Language (WML):   **3M**
The WML is a Tag-based browsing language: it provides the following features
Screen management (text, images)
Data input (text, selection lists, etc.)
Hyperlinks & navigation support
• W3C XML-based language
• Inherits technology from HDML and HTML
WML document is made up of multiple cards. Cards can be grouped into decks .it identified by URL
WMLScript
• Scripting language: it supports the Procedural logic, loops, conditionals, etc.it Optimized for small-memory, small-cpu devices.
• Derived from JavaScript
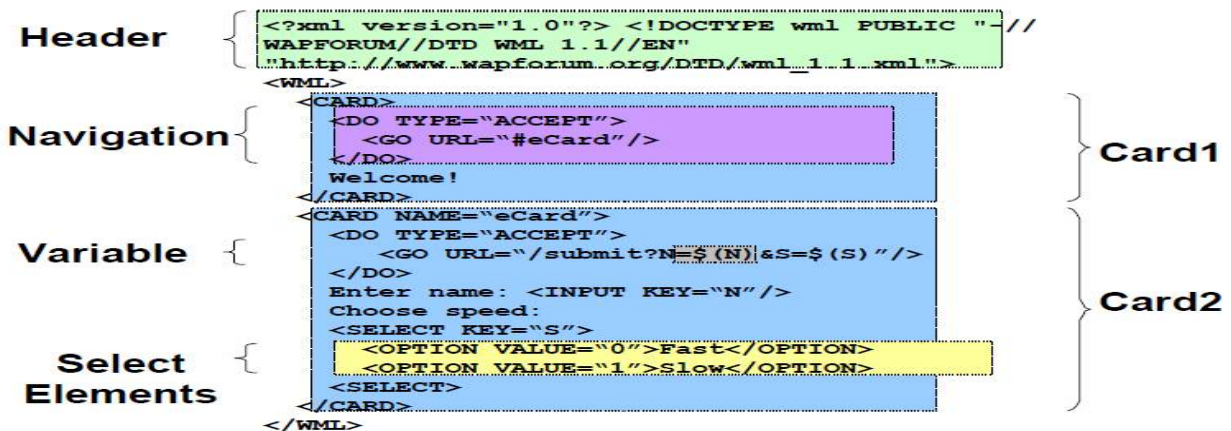• Integrated with WML
It is a Powerful extension mechanism and it reduces overall network traffic

How to Make WML page:

1. Write your own code
2. Convert from HTML
3. Visual tools

WML Example: **3M**

WML Example

Signature of the HOD.

Signature of the internal Examiner (B. Krishnaiah)

Name of the external Examiners	Name of the college	Dept.	Signature