

Chapter	Contents	Page No
I	Introduction to Wireless Network	1
	1.1. Introduction	1
	1.2. Infrastructure Wireless Networks	2
	1.3. Infrastructure Less Wireless Networks	3
	1.4. Wireless Personal Area Networks	3
	1.4.1. High Rate Wireless Personal Area Networks	4
	1.4.2. Low Rate Wireless Personal Area Networks	8
	1.5. Bluetooth Technology	11
	1.5.1. Bluetooth Background	11
	1.5.2. Bluetooth Protocol	12
	1.5.3. Application of Bluetooth Technology	13
	1.5.4. Bluetooth Limitations	14
	1.6. Wireless LAN Networking	14
	1.6.1. WLAN Advantages	15
	1.6.2. IEEE Wireless Networking Specifications	16
	1.6.3. Different WLAN Technologies	18
	1.7. Infrared	20
	1.8. IEEE 802.11 Extensions	22
	1.9. Wireless MAN Networking	24
	1.9.1. The IEEE 802.16 Wireless MAN Standard	25
	1.9.2. WMAN: Back Haul and Last Mile	25
	1.9.3. WiMax	26
	1.10. Wireless WAN Networking	28
	1.11. Different Types of Network	30
	1.12. Summary	31
	Abbreviations	32
	Review Questions	33

Research Perspective Questions	33
II Mobile Ad Hoc Network	34
2.1. Introduction	34
2.2. History	34
2.3. Cellular and Ad hoc Wireless Networks	35
2.4. Mobile Ad hoc Network	35
2.4.1. MANET Characteristics	36
2.4.2. MANET Challenges	37
2.4.3. Ad Hoc Network Topology	39
2.4.4. MANET Routing	41
2.5. MANET Protocols	42
2.5.1. Proactive Routing Protocols	46
2.5.2. Reactive Routing Protocols	47
2.5.3. Hybrid Routing Protocols	50
2.5.4. Multicast Routing Protocols	52
2.6. Issues in Ad Hoc Wireless Networks	55
2.7. Summary	57
Abbreviations	58
Review Questions	59
Research Perspective Questions	59
III Clustering and Mobility Model for MANET Topology	60
3.1. Introduction	60
3.2. Hierarchical Algorithms	60
3.3. Cluster Formation and Cluster Head Selection	63
3.4. Cluster Maintenance	68
3.4.1. Intra-Cluster Maintenance	68
3.4.2. Inter-cluster maintenance	68
3.4.3. Cluster-Based Routing	68

3.5. Different Type of Clustering	69
3.5.1. Location Based Clustering	69
3.5.2. Mobility Based Clustering	69
3.5.3. Neighbor Based Clustering	70
3.5.4. Power Based Clustering	71
3.5.5. Artificial Intelligence Based Clustering	72
3.5.6. Weighed Based Clustering	73
3.5.7. Cluster Based MANET Algorithms	74
3.5.8. Benefits of Clustering in MANET	77
3.5.9. Limitations of Clustering	77
3.6. MANET Mobility Models	78
3.6.1. Entity Mobility Model	80
3.6.2. Group Mobility Model	84
3.6.3. Mobility with Temporal Dependency	85
3.6.4. Limitations of the Random Waypoint Model	86
3.7. Metric Components	87
3.7.1. Performance Metrics	87
3.7.2. Threshold Factor	89
3.8. Summary	90
Abbreviations	91
Review Questions	91
Research Perspective Questions	92
IV Clustering Schemes for Mobile Ad Hoc Network	93
4.1. Introduction	93
4.2. MANET Clustering Heuristics	93
4.2.1. Distributed Clustering	94
4.2.2. The Lowest-ID Algorithm	97
4.2.3. Highest-Degree Heuristic	98

4.3. Clustering Scheme	100
4.4. Classifications of Clustering Schemes	101
4.4.1. DS-Based Clustering	103
4.4.2. Low-Maintenance Clustering	106
4.4.3. Mobility-Aware Clustering	111
4.4.4. Comparison of MOBIC and DDCA	113
4.4.5. Energy-Efficient Clustering	114
4.5. Adaptive Multi-Hop Clustering (AMC)	116
4.6. Summary	117
Abbreviations	119
Review Questions	119
Research Perspective Questions	120
V Wireless Sensor Network Routing and MAC Protocol	121
5.1. Introduction	121
5.2. Basic Overview of Technology	122
5.3. Applications of Wireless Sensor Network	123
5.4. Structure of a Wireless Sensor Network	125
5.5. Medium Access Control	127
5.5.1. Possible WSN Protocol Stack	127
5.5.2. Definition and Classification of MAC Protocols	129
5.5.3. Schedule-based MAC Protocols	129
5.5.4. CSMA/CA Mechanism	131
5.6. Routing	131
5.6.1. Routing Challenges	132
5.6.2. Routing Protocols Classification	134
5.6.3. Route Discovery	138
5.7. Hardware and Operating System for WSN	141
5.8. Wireless Radio Communication Characteristics	143

5.9. Medium Access Schemes	143
5.10. Deployment	145
5.11. Localization	146
5.12. Synchronization	147
5.13. Calibration	148
5.14. Network Layer Issues	149
5.15. Transport Layer Issues	150
5.16. Data Aggregation and Data Dissemination	151
5.17. Database Centric and Querying	152
5.18. Architecture	153
5.18.1. Programming Models for Sensor Networks	154
5.18.2. Middleware	155
5.19. Quality of Service	156
5.20. Security	157
5.21. Network Design Issues	159
5.22. Summary	160
Abbreviations	161
Review Questions	161
Research Perspective Questions	162
VI Biometric and Intrusion Detection based MANET Security	164
6.1. Introduction	164
6.2. Security Attacks in MANET	164
6.3. Classifications of MANET Attacks	165
6.3.1. Black Hole	166
6.3.2. Byzantine Attack	166
6.3.3. Spoofing Attack	167
6.3.4. Sybil Attack	167
6.3.5. Wormhole Attack	168

6.3.6. Denial of Service Attack (DoS)	168
6.3.7. Distributed Denial-of-Service (DDoS) Attack	169
6.4. Detection Mechanism against the Attacks in MANET	169
6.5. Biometrics Classification	172
6.5.1. Physiological Biometrics	172
6.5.2. Behavioral Biometrics	173
6.6. Unimodal and Multi Modal Biometric System	174
6.6.1. Limitations of Unimodal Biometric Systems	174
6.6.2. Integration Scenarios of Multi Modal Biometrics	175
6.7. Biometric Systems Architecture	176
6.8. Finger Print and Iris Identification	180
6.9. Intrusion Detection System	181
6.10. Classifications of Intrusion Detection in MANET	182
6.10.1. Network Intrusion Detection (NID)	183
6.10.2. Host Intrusion Detection (HID)	184
6.10.3. Cross Layer Techniques in IDS	185
6.11. IDS Architecture for MANET	186
6.12. Hierarchical IDS Architecture	188
6.13. Limitation of IDS for MANET	191
6.14. Biometric-Based Authentication and IDS in MANET	192
6.15. Dempster-Shafer Model	193
6.15.1. DS Theory for Multimodal Biometric Fusion	193
6.15.2. Fusion Operators	194
6.16. Summary	195
Abbreviations	196
Review Questions	196
Research Perspective Questions	197

VII Research Issues and Trends in Wireless Network	198
7.1. Introduction	198
7.2. Research Issues in Mobile Ad Hoc Network	198
7.2.1. The Major Challenges Faced by MANET	199
7.2.2. Represent a Spectrum of Network Challenges	199
7.2.3. Environmental Limitations	200
7.2.4. WPAN Open Research Problems	204
7.3. Research Trends in MANET	205
7.4. Problems and Performance Requirements for MAC Protocols	206
7.5. Research Issues in Wireless Sensor Network	208
7.5.1. Research Issues in Biological Applications	208
7.5.2. Research Issues in Commercial Applications	209
7.5.3. Research Issues in Environmental Applications	211
7.5.4. Research Issues in Healthcare Applications	211
7.5.5. Research Issues in Industrial Applications	213
7.5.6. Research Issues in Military Applications	213
7.6. Challenges and Hurdles	214
7.7. Issues of Clustering	217
7.8. Simulation Modeling	218
7.9. Summary	219
Abbreviations	221
Review Questions	221
Glossary of Terms	
Index	
References	