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| 20XWAM WIRELESS NETWORKS **3 2 0 4**  **Prerequisites**   * 20XW42 COMPUTER NETWORKS AND TCP/IP   **WIRELESS NETWORK OVERVIEW:**Wired and wireless Networks- Effect of mobility on systems**-** Introduction to wireless technologies- RF Overview - Wireless Signal Propagation-Signal-to-Noise Ratio – Modulation - ISM Spectrum - Frequency Hopping Spread Spectrum (FHSS) - Direct Sequence Spread Spectrum (DSSS)- Orthogonal Frequency Division Multiplexing (OFDM) -Coordination mechanisms and MAC protocols for multi-user network access | (6) |
| **WLAN TECHNOLOGIES**:  **:**IEEE 802.11 Standard--WPA(Wi- Fi Protected Access)-WPA2- WEP (wired Equivalence Privacy)- Static WEP Wireless Architecture- Bluetooth –ZigbeeWireless data networks-Personal Area Networks-GPRS architecture. | (12) |
| **AD HOC AND SENSOR NETWORKS:** Ad hoc Network- Characteristics- Table-driven and Source-initiated On Demand routing protocols, Hybrid protocols -. Wireless Sensor networks- Classification, MAC and Routing Protocols. | (8) |
| **MOBILE NETWORK AND TRANSPORT LAYERS**: Mobile IP – Dynamic Host Configuration Protocol-Mobile Ad Hoc Routing Protocols–Multicast routing-TCP over Wireless Networks – Indirect TCP – Snooping TCP – MobileTCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freezing-Selective Retransmission – Transaction Oriented TCP- TCP over 2.5 / 3G wireless Networks. | (8) |
| **Wireless Threats and Risks:**Security breaches on wireless Networks- Eavesdropping-Jamming - RF interference -Covert wireless channels-Traffic Analysis Spoofing- DOS attack - Malicious Code -Cryptographic threats- Rogue Access Points - MAC Filtering Attacks - Attack on MiC - RADIUS Vulnerabilities – WPA and 802.1x Vulnerabilities - Attacks on Wireless Gateways | (8) |
| **FUTURE TRENDS**:  Emerging WLAN Related Technologies – 802.16 – 802.20 – 802.22 – UWB, Cognitive Radios,  RFID – 4G and Data Communications Convergence. | (8) |
| **TUTORIAL PRACTICE:**   1. Study of OMNET++/NS-2 simulator. 2. Simulation of a IEEE 802.11 LAN under various conditions using chosen simulator. 3. Simulation of a priority MAC protocol using chosen simulator. 4. Simulation of different routing protocols using simulators. 5. Simulation of TCP over error-prone wireless network using simulator. 6. Development of Mobile application using blue tooth. |  |

**Total L: 45+T: 30 = 75**

**TEXTBOOKS:**

1. William Stallings, “Wireless Communication and Networks”, Pearson Education, 2016.
2. Gary. S. Rogers and John Edwards, “An Introduction to Wireless Technology”, Pearson Education, 2012.
3. SivaRam Murthy C and B.S Manoj, “Ad hoc Wireless Networks Architecture and Protocols”, Pearson Education, 2012.
4. KavehPahlavan, Prashant K. Krishnamurthy, “Principles of Wireless Networks : A Unified Approach”, John Wiley, 2011.

**REFERENCES:**

1. Dharma PrakashAgrawal and Qing-An Zeng, “Introduction to Wireless and Mobile Systems”, Thomson Press, 2007.
2. Feng Zhao and  Leonidas Guibas, “Wireless Sensor Networks-An Information Processing Approach”, Elsevier, 2004.
3. Ivan Stojmenovic, “Handbook of Wireless Networks and Mobile Computing”, John Wiley, 2006.
4. SavoGlisic, “Advanced Wireless Communications 4G Technologies”, Wiley Publications, 2006.

### 20XWAN NETWORK FORENSICS

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**3 2 0 4**

**Prerequisites**

* 20XW42 COMPUTER NETWORKS AND TCP/IP
* 20XW45 OPERATING SYSTEMS

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| **INTRODUCTION** :Footprints  -  Concepts in Digital Evidence - Network Forensics Investigative Methodology (OSCAR) - Sources of Network-Based Evidence  - Evidence Acquisition | (6) |
| **TRAFFIC ANALYSIS:**Protocol Analysis - Packet Analysis  - Flow Analysis – Higher Layer Traffic Analysis | (8) |
| **STATISTICAL FLOW ANALYSIS:** Process Overview – Sensors - Flow Record Export protocols - Collection and Aggregation – Analysis. | (7) |
| **NETWORK INTRUSION DETECTION AND ANALYSIS:** Why Investigate NIDS/NIPS? -Typical NIDS/NIPS Functionality - Modes of Detection - Types of NIDS/NIPSs  - NIDS/NIPS Evidence Acquisition  - Comprehensive Packet Logging - Snort | (9) |
| **EVENT LOG AGGREGATION, CORRELATION, AND ANALYSIS:**  Sources of Logs  - Network Log Architecture - Collecting and Analyzing Evidence – Switch Evidence – Router Evidence – Firewall Evidence | (6) |
| **WEB PROXIES:**Why Investigate Web Proxies? - Web Proxy Functionality  - Evidence - Squid  - Web Proxy Analysis - Encrypted Web Traffic | (9) |
| **TUTORIAL PRACTICE:** Analysis of the packets and flow analysis using Wireshark and tshark.Analysis of higher level protocols like DHCP, DNS, SMTPFamiliarize with various tools like netflow, silk for flow analysisFamiliarize with Network Intrusion detection tools like SnortLog analysis and event correlationWeb proxy analysis. |  |

**Total L: 45+T: 30=75**

**TEXTBOOKS:**

* 1. Davidoff, Sherri, and Jonathan Ham, “Network forensics: tracking hackers through cyberspace”, Vol. 2014, Upper Saddle River: Prentice hall, 2012.

**REFERENCES:**

* + - 1. “Investigating Network Intrusions and Cybercrime”, EC Council, 2016.

# Jessy Bullock, Jeff Parker, “Wireshark for Security Professionals: Using Wireshark and the Metasploit Framework” , Wiley, 2017.

* + - 1. Bejtlich, Richard, “The practice of network security monitoring: understanding incident detection and response”, No Starch Press, 2013.

### 20XWAO RANDOMIZED ALGORITHMS

**3 2 0 4**

**Prerequisites**

* 20XW31 PROBABILITY AND STATISTICS
* 20XW34 DESIGN AND ANALYSIS OF ALGORITHMS

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| **INTRODUCTION:** Randomized algorithms, randomized quick sort, Karger’s min-cut algorithm Las Vegas and Monte Carloalgorithms, computational models and complexity classes. | (5) |
| **MOMENT, DEVIATION AND TAIL INEQUALITIES:** Occupancy problem**,** Markov and Chebyshev inequalities- randomized selection- coupon collector’s problem, the Chernoff bound- routing in a parallel computer- a wiring problem. | (7) |
| **PROBABILISTIC METHODS:** Overview of the method-maximum satisfiability - finding a large cut, Expander graphs. | (5) |
| **MARKOV CHAINS AND RANDOMWALKS:** Markov chains, Random walk on graphs - connectivity in undirected graphs – Expanders and rapidly mixing random walks. | (6) |
| **DATA STRUCTURES AND GRAPH ALGORITHMS:** Random Treaps, hashing – hash tables – perfect hashing, skip lists **-** Fast in-cut. | (6) |
| **ONLINE ALGORITHMS:** Paging problem-adversary models- paging against an oblivious adversary-relating the adversaries-the adaptive online adversary, k-server problem. | (5) |
| **PARALLEL AND DISTRIBUTED ALGORITHMS**: Sorting on a PRAM – Maximal Independent sets. | (4) |
| **NUMBER THEORETIC ALGORITHMS:**, Polynomial roots and factoring, primality testing. | (3) |
| **DERANDOMIZATION:** The method of Conditional Probabilities – Derandomizing max-cut algorithm – Constructing pairwise independent values modulo a prime - Pairwise independent – large cut. | (4) |
| **TUTORIAL PRACTICE:**   1. Implementation of randomized quick sort and solve real time problems using it. 2. Find solution for s-t min-cut problem adapting min cut algorithm. 3. Implementation of randomized selection and problems related to it. 4. Implementation of treap data structure. 5. Problems using randomized hash table. 6. Implement the shortest path and fast min-cut algorithms. 7. Implementation of randomized primality testing. 8. Implement the K-server on-line algorithms. |  |

**Total: L: 45+T: 30 = 75**

**TEXTBOOKS:**

1. Motwani R and RaghavanP,“Randomized Algorithms”, Cambridge University Press, 2010.
2. Michael Mitzenmacher and Eli Upfal, “Probability & Computing: Randomized Algorithms and Probabilistic Analysis”, Cambridge University Press, 2009.

**REFERENCES:**

1. Thomas H Cormen, Charles E Leiserson and Ronald L Rivest, “Introduction to Algorithms”, MIT Press, 2009.
2. AnanyLevitin, “Introduction to Design and Analysis of Algorithms”, Pearson Education, 2011.

### 20XWAP REINFORCEMENT LEARNING

**3 2 0 4**

**Prerequisites**

* 20XW53 MACHINE LEARNING
* 20XW62 ARTIFICIAL INTELLIGENCE

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| **REINFORCEMENT PROBLEM**: Introduction - Elements of RL, History of RL- Evaluative feedback -Goals and rewards – Returns -Bandit learning: Upper-confidence - bound algorithms - Thompson sampling, online learning - Multi agent reinforcement learning | (6) |
| **MARKOV DECISION PROCESS (MDP)** – Value functions - Optimality Criterion in MDPs.- Partially Observed Markov Decision Process | (4) |
| **DYNAMIC PROGRAMMING (DP)**: Policy Evaluation- Policy Improvement - Value Iteration, asynchronous DP- Efficiency of DP- Stochastic DP | (5) |
| **MONTE CARLO METHODS**: Policy Evaluation- Policy Improvement- On-policy and off- policy Monte Carlo controls-Incremental implementation. | (8) |
| **TEMPORAL DIFFERENCE LEARNING (TD)**: TD-prediction- Optimality of TD - Sarsa- Q-Learning – R- Learning-Actor-Critic Model- Unifying Monte Carlo and TD-Traces- Games. | (8) |
| **FUNCTION APPROXIMATION**- Value prediction and control – Gradient Descent methods-Linear methods – Artificial Neural Network based approximation- lazy learning - Policy Gradient methods- REINFORCE algorithm, exact gradient methods, estimating gradients, approximate policy gradient algorithms, actor-critic methods - Deep Q Learning - Inverse RL. | (9) |
| **PLANNING AND LEARNING**: Model based learning and planning - prioritized sweeping-Heuristic search. | (5) |
| **TUTORIAL PRACTICE:**   1. Ranking of nodes of a graph using Q-Learning (PageRank, TrustRank, DistanceRank, focused crawler). 2. Applying n-armed Bandits in real world problems. 3. Finding shortest paths in graphs using RL.(Online algorithms) 4. RL for Stochastic grid word. 5. Multi-agent system and games. 6. Distributed RL. 7. Policy Search algorithms. |  |

**Total L: 45+T:30 = 75**

**TEXTBOOKS:**

* + - 1. Sutton R. S. and Barto A. G., "Reinforcement Learning: An Introduction", MIT Press, 2018.

1. Dimitri P. Bertsekas, "Reinforcement Learning and Optimal Control”, Athena Scientific, 2019
2. CsabaSzepesvári, “Algorithms for Reinforcement Learning”, Morgan & Claypool, 2010.

**REFERENCES:**

* + - 1. Lattimore, T. and Szepesvári, C.” Bandit Algorithms”, Cambridge University Press, 2018.
      2. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Pearson, 2020.
      3. Masashi Sugiyama, “Statistical Reinforcement Learning : Modern Machine Learning Approaches”, CRC Press, Taylor & Francis Group, 2015.

### 20XWAQ COMPUTER FORENSICS

**3 2 0 4**

**Prerequisites**

* 20XW42 COMPUTER NETWORKS AND TCP/IP
* 20XW45 OPERATING SYSTEMS

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| **COMPUTER AND FORENSICS:** Introduction – Stand-alone computer crimes –Computer evidence – Computer Forensics evidence and courts –Internet laws and statutes; Forensics process – Securing evidence – Law enforcement and methodology | (8) |
| **FORENSICS EVIDENCE**: Sources – Seizure – Collection – Integrity – Handling; Acquisition and Duplication of data. | (8) |
| **DATA ANALYSIS**: Metadata extraction – File Signature analysis – System analysis – Examining unallocated space – Data carving – Recovering deleted data and partitions. | (6) |
| **WINDOWS FORENSICS**: Registry Analysis – Executable file analysis – Recycle Bin Forensics – Evidence Recovery from Print and Spool files. | (5) |
| **INTERNET FORENSICS**: Domain Name Ownership Investigation – Email Forensics – Messenger Forensics – Browser Forensics. | (6) |
| **MOBILE DEVICE FORENSICS**: Hand-held devices and Forensics – Reconstructing user’s activities and deleted data. | (4) |
| **MEMORY FORENSICS AND MALWARE ANALYSIS**: Memory data collection and Examination – Analyzing Windows and Linux systems for malware – Reverse Engineering tools and techniques. | (6) |
| **ANTI-FORENSICS**: Erasing Evidence. | (2) |
| **TUTORIAL PRACTICE:**   1. Implementation of data analysis techniques. 2. Implementation of system analysis concepts. 3. Implementation of email forensics concepts. 4. Implementation of hand-held device forensics activities. |  |

**Total L: 45+T: 30=75**

**TEXTBOOKS:**

1. Marjie T. Britz, "Computer Forensics and Cyber Crime: An Introduction", Pearson Education, 2013.
2. Linda Volonino, Reynaldo Anzaldua, Jana Godwin, "Computer Forensics: Principles and Practices", Pearson/Prentice Hall, 2007.

**REFERENCES:**

* + - 1. Chuck Easttom, "System Forensics, Investigation, and Response", Jones & Bartlett Publishers, 2014.
      2. SatishBommisetty, RohitTamma, Heather Mahalik, "Practical Mobile Forensics", Packt Publishing Ltd, 2014.
      3. Robert Jones, "Internet Forensics ", O'Reilly Media, 2005.

**OPEN ELECTIVES**

### 20XWO1 PRINCIPLES OF MANAGEMENT AND BEHAVIOURAL SCIENCES

**3 2 0 4**

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| **PRINCIPLES OF MANAGEMENT:** Meaning, Definition and Significance of Management, Basic Functions of Management – Planning, Organizing, Staffing, Directing and Controlling. Organizational Environment – Social, Economic, Technological and Political. Corporate Social Responsibility - Case discussion | (8) |
| **INDUSTRIAL AND BUSINESS ORGANIZATION:** Growth of Industries (Small Scale, Medium Scale and Large Scale Industries). Forms of Business Organizations. Resource Management – Internal and External Sources. | (7) |
| **ORGANIZATIONAL BEHAVIOUR:** Significance of OB, Impact of culture on organization. Role of leadership and leadership styles. Personality and Motivational Theories. Attitudes, Values and Perceptions at work - Case discussion | (7) |
| **GROUP BEHAVIOUR:** Group dynamics, Group formation and development, group structure and group cohesiveness. Informal organization – Sociometry – Interaction analysis – Exercises. | (8) |
| **GLOBALISATION: I**ssues for global competitiveness, proactive and reactive forces of globalization. Cross cultural management – Management of work force diversity. | (5) |
| **HUMAN RESOURCE MANAGEMENT:** Objectives and Functions, Selection and Placement, Training and Development – Conflict management – Stress management - Human resource management in global environment - Human resource information system(HRIS) - Case discussion. | (10) |
| **TUTORIAL PRACTICE:**  Case studies |  |

**Total L: 45+T: 30=75**

**TEXTBOOKS:**

1. Harold Koontz, Heinz Weihrich and RamachandraAryasri, “Principles of Management”, Tata McGraw Hill, 2014.
2. Mamoria CB, “Personnel Management”, Sultan Chand & Sons, 2005.

**REFERENCES:**

1. John W Newstrom and Keith Davis, “Organizational Behavior”, Tata McGraw Hill, 2010.
2. Stephen P Robbins, ”Organisational behavior”, Prentice Hall, 2010.
3. Khanna O P, “Industrial Engineering & Management”, DhanpatRai Publications, 2010.

### 20XWO2 ENTERPRENEURSHIP

**3 2 0 4**

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| **INTRODUCTION TO ENTREPRENEURSHIP:** Definition – Characteristics and Functions of an Entrepreneur – Common myths about entrepreneurs – Importance or Entrepreneurship. | (5) |
| **CREATIVITY AND INNOVATION:** The role of creativity – The innovation Process – Sources of New Ideas – Methods of Generating Ideas – Creative Problem Solving – Entrepreneurial Process. | (6) |
| **DEVELOPING AN EFFECTIVE BUSINESS MODEL:** The Importance of a Business Model – Starting a small scale industry - Components of an Effective Business Model | (5) |
| **APPRAISAL OF PROJECTS:** Importance of Evaluating Various options and future investments- Entrepreneurship incentives and subsidies – Appraisal Techniques | (8) |
| **FORMS OF BUSINESS ORGANIZATION:** Sole Proprietorship – Partnership – Limited liability partnership - Joint Stock Companies and Cooperatives. | (4) |
| **FINANCING THE NEW VENTURE:**Determining Financial Needs – Sources of Financing – Equity and Debt Funding – Case studies in Evaluating Financial Performance. | (8) |
| **THE MARKETING FUNCTION:** Industry Analysis – Competitor Analysis – Marketing Research for the New Venture – Defining the Purpose or Objectives – Gathering Data from Secondary Sources – Gathering Information from Primary Sources – Analyzing and Interpreting the Results – The Marketing Process**.** | (5) |
| **INTELLECTUAL PROPERTY PROTECTION AND ETH ICS:** Patents – Copyright - Trademark- Geographical indications – Ethical and social responsibility and challenges. | (4) |
| **TUTORIAL PRACTICE:**  Case studies |  |

**Total L: 45+T: 30=75**

**TEXTBOOKS:**

1. Donald F.Kuratko and Richard M.Hodgetts, “Entrepreneurship”, South-Western, 2003.
2. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2010.

**REFERENCES:**

1. S.L.Gupta, Arun Mittal, “Entrepreneurship Development”, International Book House, 2012.
2. G. S. Sudha, “Management and Entrepreneurship Development”, Indus Valley Publication, 2009.
3. V. Badi, N. V. Badi , Business Ethics, R, Vrinda Publication, 2012.
4. Prasanna Chandra Projects- Planning, Analysis, Financing, Implementation andreview, TATA McGraw Hill, 2012.