Contents at a Glance

Introduct	ion		xxxiii
Assessmen	nt Test		xlii
Chapter	1	Security Governance Through Principles and Policies	1
Chapter	2	Personnel Security and Risk Management Concepts	49
Chapter	3	Business Continuity Planning	97
Chapter	4	Laws, Regulations, and Compliance	125
Chapter	5	Protecting Security of Assets	159
Chapter	6	Cryptography and Symmetric Key Algorithms	195
Chapter	7	PKI and Cryptographic Applications	237
Chapter	8	Principles of Security Models, Design, and Capabilities	275
Chapter	9	Security Vulnerabilities, Threats, and Countermeasures	319
Chapter	10	Physical Security Requirements	399
Chapter	11	Secure Network Architecture and Securing Network Components	439
Chapter	12	Secure Communications and Network Attacks	521
Chapter	13	Managing Identity and Authentication	579
Chapter	14	Controlling and Monitoring Access	623
Chapter	15	Security Assessment and Testing	661
Chapter	16	Managing Security Operations	697
Chapter	17	Preventing and Responding to Incidents	737
Chapter	18	Disaster Recovery Planning	801
Chapter	19	Investigations and Ethics	845
Chapter	20	Software Development Security	871
Chapter	21	Malicious Code and Application Attacks	915
Appendix	A	Answers to Review Questions	949
Appendix	В	Answers to Written Labs	987
Index			1001

Contents

10		xxxiii
Introduction	Plantan und anakunga watervolumi	1
Assessment Test		xlii
Chapter 1	Security Governance Through Principles and	
00	Policies	1
	Understand and Apply Concepts of Confidentiality, Integrity,	
	and Availability	2
	Confidentiality	3
	Integrity Annual Property Chamber	4
	Availability	6
	Other Security Concepts	8
	Protection Mechanisms	12
	Layering	12
	Abstraction	13
	Data Hiding	13
	Encryption	14
	Evaluate and Apply Security Governance Principles	14
	Alignment of Security Function to Business Strategy,	
	Goals, Mission, and Objectives	15
	Organizational Processes	17
	Organizational Roles and Responsibilities	23
	Security Control Frameworks	25
	Due Care and Due Diligence	26
	Develop, Document, and Implement Security Policy,	
	Standards, Procedures, and Guidelines	26
	Security Policies	26
	Security Standards, Baselines, and Guidelines	28
	Security Procedures	28
	Understand and Apply Threat Modeling Concepts and	
	Methodologies	30
	Identifying Threats	31
	Determining and Diagramming Potential Attacks	35
	Performing Reduction Analysis	36
	Prioritization and Response	37
	Apply Risk-Based Management Concepts to the Supply Chain	38
	Summary	40
	Exam Essentials	42
	W/ I -b	44
	Review Questions	45

Personnel Security Policies and Procedures Candidate Screening and Hiring Employment Agreements and Policies Onboarding and Termination Processes Vendor, Consultant, and Contractor Agreements and Controls Compliance Policy Requirements 60 Privacy Policy Requirements 61 Security Governance Understand and Apply Risk Management Concepts Risk Terminology 64 Identify Threats and Vulnerabilities 67 Risk Assessment/Analysis 68 Risk Responses 76 Countermeasure Selection and Implementation Applicable Types of Controls Security Control Assessment Monitoring and Measurement Asset Valuation and Reporting Continuous Improvement Risk Frameworks Establish and Maintain a Security Awareness, Education, and Training Program Manage the Security Function Summary Exam Essentials Written Lab Written Lab Review Questions Chapter 3 Business Continuity Planning Planning for Business Continuity Project Scope and Planning Business Organization Analysis BCP Team Selection 101 Resource Requirements 104 Business Impact Assessment 105 Identify Priorities 106 Risk Identification 107 Likelihood Assessment 108	Chapter	2 Personnel Security and Risk Management Concepts	49
Candidate Screening and Hiring		Personnel Security Policies and Procedures	51
Employment Agreements and Policies			55
Onboarding and Termination Processes S7			
Vendor, Consultant, and Contractor Agreements and Controls 60			
Agreements and Controls			
Compliance Policy Requirements			60
Privacy Policy Requirements Security Governance Understand and Apply Risk Management Concepts Risk Terminology Identify Threats and Vulnerabilities Risk Assessment/Analysis Risk Responses Risk Responses Countermeasure Selection and Implementation Applicable Types of Controls Security Control Assessment Monitoring and Measurement Asset Valuation and Reporting Continuous Improvement Risk Frameworks Establish and Maintain a Security Awareness, Education, and Training Program Manage the Security Function Summary Exam Essentials Written Lab Review Questions Chapter 3 Business Continuity Planning Planning for Business Continuity Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements Identify Priorities Risk Identification Likelihood Assessment 105 Likelihood Assessment 106 Likelihood Assessment 108		LUTTER DOUBLES IN THE STANDARD SEE TO SECURIORISE SEEDINGS AND ADDRESS OF THE SECURIORISE SECURIORISMO	60
Security Governance Understand and Apply Risk Management Concepts Risk Terminology Identify Threats and Vulnerabilities Risk Assessment/Analysis Risk Responses Countermeasure Selection and Implementation Applicable Types of Controls Security Control Assessment Monitoring and Measurement Asset Valuation and Reporting Continuous Improvement Risk Frameworks Establish and Maintain a Security Awareness, Education, and Training Program Manage the Security Function Summary Exam Essentials Written Lab Review Questions Chapter 3 Business Continuity Planning Project Scope and Planning Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements Identify Priorities Risk Identification Likelihood Assessment 108			61
Understand and Apply Risk Management Concepts Risk Terminology Identify Threats and Vulnerabilities Risk Assessment/Analysis Risk Responses Countermeasure Selection and Implementation Applicable Types of Controls Security Control Assessment Analysis Asset Valuation and Reporting Continuous Improvement Risk Frameworks Establish and Maintain a Security Awareness, Education, and Training Program Manage the Security Function Summary Exam Essentials Written Lab Review Questions Chapter 3 Business Continuity Planning Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements Legal and Regulatory Requirements Identify Priorities Risk Identification Likelihood Assessment 108			62
Risk Terminology Identify Threats and Vulnerabilities Risk Assessment/Analysis Risk Responses Countermeasure Selection and Implementation Applicable Types of Controls Security Control Assessment Monitoring and Measurement Asset Valuation and Reporting Continuous Improvement Risk Frameworks Establish and Maintain a Security Awareness, Education, and Training Program Manage the Security Function Summary Exam Essentials Written Lab Review Questions Chapter 3 Business Continuity Planning Planning for Business Continuity Project Scope and Planning Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements Identify Priorities Risk Identification Likelihood Assessment 105 Risk Identification Likelihood Assessment 106 Risk Identification Likelihood Assessment 107			63
Identify Threats and Vulnerabilities			64
Risk Assessment/Analysis 68 Risk Responses 76 Countermeasure Selection and Implementation 77 Applicable Types of Controls 79 Security Control Assessment 81 Monitoring and Measurement 81 Asset Valuation and Reporting 82 Continuous Improvement 83 Risk Frameworks 83 Establish and Maintain a Security Awareness, Education, and Training Program 86 Manage the Security Function 87 Summary 88 Exam Essentials 89 Written Lab 92 Review Questions 93 Review Questions 93 Planning for Business Continuity 98 Project Scope and Planning 99 Business Organization Analysis 100 Resource Requirements 101 Resource Requirements 103 Legal and Regulatory Requirements 104 Business Impact Assessment 105 Identify Priorities 106 Risk Identification 107 Likelihood Assessment 108 1			67
Risk Responses Countermeasure Selection and Implementation Applicable Types of Controls Security Control Assessment Monitoring and Measurement Asset Valuation and Reporting Continuous Improvement Risk Frameworks Establish and Maintain a Security Awareness, Education, and Training Program Manage the Security Function Summary Exam Essentials Written Lab Review Questions Chapter 3 Business Continuity Planning Planning for Business Continuity Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements Business Impact Assessment Identify Priorities Risk Identification Likelihood Assessment 105 Likelihood Assessment 106 Risk Identification Likelihood Assessment 107			68
Countermeasure Selection and Implementation Applicable Types of Controls Security Control Assessment Monitoring and Measurement Asset Valuation and Reporting Continuous Improvement Risk Frameworks Establish and Maintain a Security Awareness, Education, and Training Program Manage the Security Function Summary Exam Essentials Written Lab Review Questions Chapter 3 Business Continuity Planning Planning for Business Continuity Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements Identify Priorities Risk Identification Likelihood Assessment 108			76
Applicable Types of Controls Security Control Assessment Monitoring and Measurement Asset Valuation and Reporting Continuous Improvement Risk Frameworks Establish and Maintain a Security Awareness, Education, and Training Program Manage the Security Function Summary Exam Essentials Written Lab Exam Essentials Written Lab Review Questions Chapter 3 Business Continuity Planning Planning for Business Continuity Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements Identify Priorities Risk Identification Likelihood Assessment 108			77
Security Control Assessment Monitoring and Measurement Asset Valuation and Reporting Continuous Improvement Risk Frameworks Establish and Maintain a Security Awareness, Education, and Training Program Manage the Security Function Summary Exam Essentials Written Lab Exam Essentials Written Lab Peroject Scope and Planning Planning for Business Continuity Project Scope and Planning Business Organization Analysis Deep Team Selection Resource Requirements Legal and Regulatory Requirements Identify Priorities Risk Identification Likelihood Assessment 108			79
Monitoring and Measurement Asset Valuation and Reporting Continuous Improvement Risk Frameworks Stablish and Maintain a Security Awareness, Education, and Training Program Manage the Security Function Summary Exam Essentials Written Lab Review Questions Chapter 3 Business Continuity Planning Planning for Business Continuity Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements Identify Priorities Risk Identification Likelihood Assessment 108			81
Asset Valuation and Reporting Continuous Improvement Risk Frameworks Stablish and Maintain a Security Awareness, Education, and Training Program Manage the Security Function Summary Summary Exam Essentials Written Lab Review Questions Chapter 3 Business Continuity Planning Planning for Business Continuity Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements Identify Priorities Risk Identification Likelihood Assessment 108			81
Continuous Improvement Risk Frameworks Risk Frameworks Establish and Maintain a Security Awareness, Education, and Training Program Manage the Security Function Summary Exam Essentials Written Lab Exam Essentials Review Questions Chapter 3 Business Continuity Planning Planning for Business Continuity Project Scope and Planning Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements Identify Priorities Risk Identification Likelihood Assessment 108			82
Risk Frameworks Establish and Maintain a Security Awareness, Education, and Training Program Manage the Security Function Summary Exam Essentials Written Lab Written Lab Review Questions Chapter 3 Business Continuity Planning Planning for Business Continuity Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements Indentify Priorities Risk Identification Likelihood Assessment 108			83
and Training Program Manage the Security Function Summary Exam Essentials Written Lab Review Questions Summary Review Questions Planning for Business Continuity Project Scope and Planning Business Organization Analysis BCP Team Selection BCP Team Selection Resource Requirements Legal and Regulatory Requirements Identify Priorities Risk Identification Likelihood Assessment 108			83
and Training Program Manage the Security Function Summary Exam Essentials Written Lab Review Questions Summary Review Questions Planning for Business Continuity Project Scope and Planning Business Organization Analysis BCP Team Selection BCP Team Selection Resource Requirements Legal and Regulatory Requirements Identify Priorities Risk Identification Likelihood Assessment 108		Establish and Maintain a Security Awareness, Education,	
Manage the Security Function Summary Exam Essentials Written Lab Review Questions Planning for Business Continuity Planning Project Scope and Planning Project Scope and Planning Business Organization Analysis BCP Team Selection BCP Team Selection Resource Requirements Legal and Regulatory Requirements 103 Legal and Regulatory Requirements Identify Priorities Identify Priorities Risk Identification Likelihood Assessment 108			86
Summary Exam Essentials Written Lab Written Lab Review Questions Summary Exam Essentials Written Lab Review Questions Summary Exam Essentials Written Lab Review Questions Summary Exam Essentials			87
Written Lab Review Questions 92 Review Questions 93 Chapter 3 Business Continuity Planning Planning for Business Continuity 98 Project Scope and Planning 99 Business Organization Analysis 100 BCP Team Selection 101 Resource Requirements 103 Legal and Regulatory Requirements 104 Business Impact Assessment 105 Identify Priorities 106 Risk Identification 107 Likelihood Assessment 108		Summary Summary Internol Manager	88
Written Lab Review Questions 92 Review Questions 93 Chapter 3 Business Continuity Planning Planning for Business Continuity 98 Project Scope and Planning 99 Business Organization Analysis 100 BCP Team Selection 101 Resource Requirements 103 Legal and Regulatory Requirements 104 Business Impact Assessment 105 Identify Priorities 106 Risk Identification 107 Likelihood Assessment 108		Exam Essentials	89
Planning for Business Continuity 98 Project Scope and Planning 99 Business Organization Analysis 100 BCP Team Selection 101 Resource Requirements 103 Legal and Regulatory Requirements 104 Business Impact Assessment 105 Identify Priorities 106 Risk Identification 107 Likelihood Assessment 108		Written I ah	92
Planning for Business Continuity 98 Project Scope and Planning 99 Business Organization Analysis 100 BCP Team Selection 101 Resource Requirements 103 Legal and Regulatory Requirements 104 Business Impact Assessment 105 Identify Priorities 106 Risk Identification 107 Likelihood Assessment 108		Review Questions	93
Planning for Business Continuity Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements Business Impact Assessment Identify Priorities Risk Identification Likelihood Assessment 108			
Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements 103 Legal and Regulatory Requirements 105 Identify Priorities Risk Identification Likelihood Assessment 108	Chapter	3 Business Continuity Planning	97
Project Scope and Planning Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements 104 Business Impact Assessment Identify Priorities Risk Identification Likelihood Assessment 108		Planning for Business Continuity	98
Business Organization Analysis BCP Team Selection Resource Requirements Legal and Regulatory Requirements Business Impact Assessment Identify Priorities Risk Identification Likelihood Assessment 108		From the state of	99
BCP Team Selection 101 Resource Requirements 103 Legal and Regulatory Requirements 104 Business Impact Assessment 105 Identify Priorities 106 Risk Identification 107 Likelihood Assessment 108			100
Legal and Regulatory Requirements Legal and Regulatory Requirements Business Impact Assessment Identify Priorities Risk Identification Likelihood Assessment 103 104 105 106 Risk Identification 107 108			101
Legal and Regulatory Requirements Business Impact Assessment Identify Priorities Risk Identification Likelihood Assessment 104 105 106 Risk Identification 107 108		Resource Requirements	103
Business Impact Assessment 105 Identify Priorities 106 Risk Identification 107 Likelihood Assessment 108		The state of the s	104
Risk Identification 108 Likelihood Assessment 108		Business Impact Assessment	105
Likelihood Assessment 107		Identify Priorities	106
Likelinood Assessment 108		Risk Identification	107
t de l'autheur		Likelihood Assessment	108
Impact Assessment 110		Zinterinto de Tradecontrette	
Resource Prioritization 111		Impact Assessment	110

		Continuity Planning	111
		Strategy Development	112
		Provisions and Processes	112
		Plan Approval and Implementation	114
		Plan Approval	114
		Plan Implementation	114
		Training and Education	115
		BCP Documentation	115
		Summary	119
		Exam Essentials	119
		Written Lab	120
		Review Questions	121
Chapter	4	Laws, Regulations, and Compliance	125
		Categories of Laws	126
		Criminal Law	126
		Civil Law	128
		Administrative Law	128
		Laws	129
		Computer Crime	129
		Intellectual Property	134
		Licensing	139
		Import/Export	140
		Privacy	141
		Compliance	149
		Contracting and Procurement	150
		Summary Amelian Amelian Summary	151
		Exam Essentials	152
		Written Lab	153
		Review Questions	154
Chapter	5	Protecting Security of Assets	159
		Identify and Classify Assets	160
		Defining Sensitive Data	160
		Defining Data Classifications	162
		Defining Asset Classifications	165
		Determining Data Security Controls	165
		Understanding Data States	168
		Handling Information and Assets	169
		Data Protection Methods	176
		Determining Ownership	178
		Data Owners	179
		Asset Owners	179

Contents

xvii

		Business/Mission Owners	180
		Data Processors	181
		Administrators	184
		Custodians	184
		Users	185
		Protecting Privacy	185
		Using Security Baselines	186
		Scoping and Tailoring	187
		Selecting Standards	187
		Summary	187
		Exam Essentials	188
		Written Lab	189
		Review Questions	190
Chapter	6	Cryptography and Symmetric Key Algorithms	195
		Historical Milestones in Cryptography	196
8014		Caesar Cipher	196
		American Civil War	197
		Ultra vs. Enigma	198
		Cryptographic Basics	198
		Goals of Cryptography	198
		Cryptography Concepts	200
		Cryptographic Mathematics	202
		Ciphers	207
		Modern Cryptography	214
		Cryptographic Keys	214
		Symmetric Key Algorithms	215
		Asymmetric Key Algorithms	216
		Hashing Algorithms	219
		Symmetric Cryptography	219
		Data Encryption Standard	220
			222
		International Data Encryption Algorithm	223
		Blowfish	223
		Skipjack	223
		Advanced Encryption Standard	224
		Symmetric Key Management	226
		Cryptographic Lifecycle	228
		Summary	229
		Exam Essentials	229
		Written Lab	231
		Review Questions	232

Chapter	7 PKI and Cryptographic Applications	237
	Asymmetric Cryptography	238
	Public and Private Keys	238
	RSA Per Maria Conno Decoma	239
	El Gamal Should plobs Red Hall	241
	Elliptic Curve	242
	Hash Functions	242
	SHA SHA Shall and Adel Adel Adel Adel Adel Adel Adel Ade	244
	MD2 See Show tsuppend analyzed	244
	MD4 Modeles Modeles Modeles MD4	245
	MD5 CondabaM guinnsG-madm2	245
	Digital Signatures	246
	HMAC HMAC HMAC HMACHEN AND AND AND AND AND AND AND AND AND AN	247
	Digital Signature Standard	248
	Public Key Infrastructure	249
	Certificates Comment of the Comment	249
	Certificate Authorities	250
	Certificate Generation and Destruction	251
	Asymmetric Key Management	253
	Applied Cryptography	254
	Portable Devices	254
	Email and the state of the second of the sec	255
	Web Applications	256
	Digital Rights Management	259
	Networking Charles and Carlotte	
	Cryptographic Attacks	265
	Summary Wallette Madagles da LaspinW	268
	Exam Essentials	269
	Written Lab	270
	Review Questions	271
	Countermeasures another Questions	395
Chapter	8 Principles of Security Models, Design,	
	and Capabilities	275
	Implement and Manage Engineering Processes Using	
	Secure Design Principles	276
	Objects and Subjects	277
	Closed and Open Systems	277
	Techniques for Ensuring Confidentiality,	2//
	Integrity, and Availability	279
	Controls	280
	Trust and Assurance	281
	Understand the Fundamental Concepts of Security Models	281
	Trusted Computing Base	282
	State Machine Model	284

	Information Flow Model	28.
	Noninterference Model	28.
	Take-Grant Model	286
	Access Control Matrix	286
	Bell-LaPadula Model	288
	Biba Model	290
	Clark-Wilson Model	292
	Brewer and Nash Model (aka Chinese Wall)	293
	Goguen-Meseguer Model	294
	Sutherland Model	294
	Graham-Denning Model	294
	Select Controls Based On Systems Security Requirements	295
	Rainbow Series	296
	ITSEC Classes and Required Assurance and Functionality	
	Common Criteria	302
	Industry and International Security	
	Implementation Guidelines	305
	Certification and Accreditation	306
	Understand Security Capabilities of Information Systems	309
	Memory Protection	309
	Virtualization	310
	Trusted Platform Module	310
	Interfaces Annual Manual Manua	311
	Fault Tolerance	311
	Summary	311
	Exam Essentials	312
	Written Lab	313
	Review Questions	314
Chapter 9	Security Vulnerabilities, Threats, and	
	Countermeasures	319
	Assess and Mitigate Security Vulnerabilities	320
	Hardware	321
	Firmware was a special to the management	341
	Client-Based Systems	342
	Applets	342
	Local Caches	344
	Server-Based Systems	346
	Database Systems Security	347
	Aggregation	347
	Inference	348
	Data Mining and Data Warehousing	348
	Data Analytics	349
	Large-Scale Parallel Data Systems	350

Contents	xxi

		Distributed Systems and Endpoint Security	350
		Cloud-Based Systems and Cloud Computing	353
		Grid Computing	357
		Peer to Peer	358
		Internet of Things	358
		Industrial Control Systems	359
		Assess and Mitigate Vulnerabilities in Web-Based Systems	360
		Assess and Mitigate Vulnerabilities in Mobile Systems	365
		Device Security	366
		Application Security	370
		BYOD Concerns	372
		Assess and Mitigate Vulnerabilities in Embedded Devices	
		and Cyber-Physical Systems	375
		Examples of Embedded and Static Systems	376
		Methods of Securing Embedded and Static Systems	377
		Essential Security Protection Mechanisms	379
		Technical Mechanisms	380
		Security Policy and Computer Architecture	383
		Policy Mechanisms	383
		Common Architecture Flaws and Security Issues	384
		Covert Channels	385
		Attacks Based on Design or Coding Flaws	
		and Security Issues	385
		Programming	388
		Timing, State Changes, and Communication Disconnects	389
		Technology and Process Integration	389
		Electromagnetic Radiation	389
		Summary and an experience of the same of t	390
		Exam Essentials	391
		Written Lab	394
		Review Questions	395
Chapter	10	Physical Security Requirements	399
481		A Proposition of the second se	
		Apply Security Principles to Site and Facility Design Secure Facility Plan	400 401
		Site Selection	401
		Visibility	401
		Natural Disasters	
		Facility Design	402
		Implement Site and Facility Security Controls	402
		Equipment Failure	403
		Wiring Closets	404
		Server Rooms/Data Centers	405
			407
		Media Storage Facilities	412

	Evidence Storage	413
	Restricted and Work Area Security	413
	Utilities and HVAC Considerations	414
	Fire Prevention, Detection, and Suppression	417
	Implement and Manage Physical Security	422
	Perimeter Security Controls	422
	Internal Security Controls	425
	Summary	431
	Exam Essentials	432
	Written Lab	434
	Review Questions	435
Chapter	11 Secure Network Architecture and Securing	
376	Network Components	439
	OSI Model	440
	History of the OSI Model	441
	OSI Functionality	441
		442
	Encapsulation/Deencapsulation OSI Layers	
	TCP/IP Model	
	TCP/IP Protocol Suite Overview	451 452
	Converged Protocols	470
	Content Distribution Networks	
	Wireless Networks	472
		472
	Securing Wireless Access Points	473
	Securing the SSID	475
	Conducting a Site Survey	476
	Using Secure Encryption Protocols	476
	Determining Antenna Placement Antenna Types	479
		480
	Adjusting Power Level Controls WPS	480
		481 481
		481
	General Wi-Fi Security Procedure Wireless Attacks	482
		486
	Secure Network Components Network Access Control	487
	Firewalls	487
	Endpoint Security Secure Operation of Hardware	491 492
	Secure Operation of Hardware	492
	Cabling, Wireless, Topology, Communications, and	105
	Transmission Media Technology Transmission Media	495 496
	Network Topologies	500
	IMPLACIES ICHMINICIPS	31111

		Wireless Communications and Security	503
		LAN Technologies	509
		Summary	513
		Exam Essentials	514
		Written Lab	516
		Review Questions	517
Chapter	12	Secure Communications and Network Attacks	521
		Network and Protocol Security Mechanisms	522
		Secure Communications Protocols	523
		Authentication Protocols	524
		Secure Voice Communications	525
		Voice over Internet Protocol (VoIP)	525
		Social Engineering	526
		Fraud and Abuse	527
		Multimedia Collaboration	529
		Remote Meeting	529
		Instant Messaging	530
		Manage Email Security	530
		Email Security Goals	531
		Understand Email Security Issues	532
		Email Security Solutions	533
		Remote Access Security Management	536
		Plan Remote Access Security	538
		Dial-Up Protocols	539
		Centralized Remote Authentication Services	540
		Virtual Private Network	540
		Tunneling by a company with the same of th	541
		How VPNs Work	542
		Common VPN Protocols	543
		Virtual LAN	545
		Virtualization	546
		Virtual Software	547
		Virtual Networking	548
		Network Address Translation	549
		Private IP Addresses	550
		Stateful NAT	551
		Static and Dynamic NAT	552
		Automatic Private IP Addressing	552
		Switching Technologies	553
		Circuit Switching	554
		Packet Switching	554
		Virtual Circuits	555

Contents xxiii

		WAN Technologies	556
		WAN Connection Technologies	558
		Dial-Up Encapsulation Protocols	561
		Miscellaneous Security Control Characteristics	561
		Transparency	561
		Verify Integrity	562
		Transmission Mechanisms	562
		Security Boundaries	563
		Prevent or Mitigate Network Attacks	564
		DoS and DDoS	564
		Eavesdropping	565
		Impersonation/Masquerading	566
		Replay Attacks	567
		Modification Attacks	567
		Address Resolution Protocol Spoofing	567
		DNS Poisoning, Spoofing, and Hijacking	568
		Hyperlink Spoofing	568
		Summary	569
		Exam Essentials	571
		Written Lab	573
		Review Questions	574
Chapter	13	Managing Identity and Authentication	579
dec.	13		579 580
Chapter	13	Controlling Access to Assets	
dec.	13		580
888 888	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls	580 581
338 540	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control	580 581 581
538 540 540 540 541	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control Comparing Identification and Authentication	580 581 581 582
538 540 540	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control	580 581 581 582 584
538 539 540 540 540 542	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control Comparing Identification and Authentication Registration and Proofing of Identity	580 581 581 582 584 585
538 539 540 540 541 542 542	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control Comparing Identification and Authentication Registration and Proofing of Identity Authorization and Accountability	580 581 581 582 584 585 586
538 540 540 540 542 542 542	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control Comparing Identification and Authentication Registration and Proofing of Identity Authorization and Accountability Authentication Factors	580 581 581 582 584 585 586 587
539 539 540 540 542 542 543	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control Comparing Identification and Authentication Registration and Proofing of Identity Authorization and Accountability Authentication Factors Passwords	580 581 581 582 584 585 586 587 588
538 540 540 540 542 542 543 544 544	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control Comparing Identification and Authentication Registration and Proofing of Identity Authorization and Accountability Authentication Factors Passwords Smartcards and Tokens	580 581 581 582 584 585 586 587 588 592
538 539 540 540 542 542 546 546 546	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control Comparing Identification and Authentication Registration and Proofing of Identity Authorization and Accountability Authentication Factors Passwords Smartcards and Tokens Biometrics	580 581 581 582 584 585 586 587 588 592 595
538 539 540 540 542 542 548 548 548 549	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control Comparing Identification and Authentication Registration and Proofing of Identity Authorization and Accountability Authentication Factors Passwords Smartcards and Tokens Biometrics Multifactor Authentication	580 581 581 582 584 585 586 587 588 592 595 599
538 539 540 540 542 542 546 548 548 548 548	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control Comparing Identification and Authentication Registration and Proofing of Identity Authorization and Accountability Authentication Factors Passwords Smartcards and Tokens Biometrics Multifactor Authentication Device Authentication	580 581 581 582 584 585 586 587 588 592 595 599 600
538 540 540 540 542 542 546 548 548 548 548 548 548	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control Comparing Identification and Authentication Registration and Proofing of Identity Authorization and Accountability Authentication Factors Passwords Smartcards and Tokens Biometrics Multifactor Authentication Device Authentication Service Authentication	580 581 581 582 584 585 586 587 588 592 595 599 600 601
538 540 540 540 541 542 543 548 548 548 548 548 548 548 548 548	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control Comparing Identification and Authentication Registration and Proofing of Identity Authorization and Accountability Authentication Factors Passwords Smartcards and Tokens Biometrics Multifactor Authentication Device Authentication Service Authentication Implementing Identity Management	580 581 581 582 584 585 586 587 588 592 595 599 600 601 602
588 539 540 540 542 542 548 548 549 549 549 549 549 549 549 549 549 549	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control Comparing Identification and Authentication Registration and Proofing of Identity Authorization and Accountability Authentication Factors Passwords Smartcards and Tokens Biometrics Multifactor Authentication Device Authentication Service Authentication Implementing Identity Management Single Sign-On	580 581 581 582 584 585 586 587 588 592 595 599 600 601 602 602
538 540 540 540 540 542 543 546 548 548 548 548 548 548 548 548 548 548	13	Controlling Access to Assets Comparing Subjects and Objects The CIA Triad and Access Controls Types of Access Control Comparing Identification and Authentication Registration and Proofing of Identity Authorization and Accountability Authentication Factors Passwords Smartcards and Tokens Biometrics Multifactor Authentication Device Authentication Service Authentication Implementing Identity Management Single Sign-On Credential Management Systems	580 581 581 582 584 585 586 587 588 592 595 599 600 601 602 602 607

		Managing the Identity and Access Provisioning Lifecycle	611
		Provisioning	611
		Account Review	612
		Account Revocation	613
		Summary Summar	614
		Exam Essentials	615
		Written Lab	617
		Review Questions	618
Chapter	14	Controlling and Monitoring Access	623
		Comparing Access Control Models	624
		Comparing Permissions, Rights, and Privileges	624
		Understanding Authorization Mechanisms	625
		Defining Requirements with a Security Policy	626
		Implementing Defense in Depth	627
		Summarizing Access Control Models	628
		Discretionary Access Controls	629
		Nondiscretionary Access Controls	630
		Understanding Access Control Attacks	635
		Risk Elements	636
		Identifying Assets	637
		Identifying Threats	638
		Identifying Vulnerabilities	640
		Common Access Control Attacks	641
		Summary of Protection Methods	652
		Summary State Address Vancanae	653
		Exam Essentials	654
		Written Lab	656
		Review Questions	657
		Baselining - Value 7 to collect	007
Chapter	15	Security Assessment and Testing	661
		Building a Security Assessment and Testing Program	662
		Security Testing	662
		Security Assessments	664
		Security Audits	665
		Performing Vulnerability Assessments	668
		Describing Vulnerabilities	668
		Vulnerability Scans	668
		Penetration Testing	679
		Testing Your Software	681
		Code Review and Testing	682
		Interface Testing	686
		Misuse Case Testing	686

Contents xxv

	Test Coverage Analysis		686
	Website Monitoring		687
	Implementing Security Management Proces	2922	688
	Log Reviews	3303	688
	Account Management		689
	Backup Verification		689
	Key Performance and Risk Indicators		690
	Summary		690
	Exam Essentials		691
	Written Lab		692
	Review Questions		693
Chapter	16 Managing Security Operations		697
	Applying Security Operations Concepts		698
	Need-to-Know and Least Privilege		698
	Separation of Duties and Responsibilit	ies	700
	Job Rotation		703
	Mandatory Vacations		703
	Privileged Account Management		704
	Managing the Information Lifecycle		706
	Service-Level Agreements		707
	Addressing Personnel Safety and Secur	rity	708
	Securely Provisioning Resources	Bion.	710
	Managing Hardware and Software Ass	sets	710
	Protecting Physical Assets		711
	Managing Virtual Assets		712
	Managing Cloud-Based Assets		713
	Media Management		714
	Managing Configuration		718
	Baselining		718
F88	Using Images for Baselining		718
	Managing Change		719
	Security Impact Analysis		721
	Versioning		722
	Configuration Documentation		723
	Managing Patches and Reducing Vulnerabi	lities	723
	Systems to Manage		723
	Patch Management		724
	Vulnerability Management		725
	Common Vulnerabilities and Exposure	S	728
	Summary		728
	Exam Essentials		729
	Written Lab		731
	Review Questions		732

Contents	*************
Contents	XXVII

Chapter	17	Preventing and Responding to Incidents	737
		Managing Incident Response	738
		Defining an Incident	738
		Incident Response Steps	739
		Implementing Detective and Preventive Measures	745
		Basic Preventive Measures	745
		Understanding Attacks	746
		Intrusion Detection and Prevention Systems	756
		Specific Preventive Measures	763
		Logging, Monitoring, and Auditing	773
		Logging and Monitoring	773
		Egress Monitoring	781
		Auditing to Assess Effectiveness	783
		Security Audits and Reviews	787
		Reporting Audit Results	788
		Summary dad nothing	790
		Exam Essentials	792
		Written Leb	
		Review Questions	795
		Review Questions	796
Chapter	18	Disaster Recovery Planning	801
AR .		The Nature of Disaster	
		Natural Disasters	802
		Man-Made Disasters	803
			807
		Understand System Resilience and Fault Tolerance	812
		Protecting Hard Drives	813
		1 Totecting Servers	814
		Protecting Power Sources Trusted Recovery	815
			816
		Quality of Service	817
		Recovery Strategy	818
		Business Unit and Functional Priorities	818
		Crisis Management Emergency Communications	819
		Zine genery Communications	820
		Workgroup recevery	820
		Title Hate Trocessing Sites	820
		Widthan Assistance Agreements	825
		Database Recovery	825
		Recovery Plan Development	827
872		Emergency Response	828
		Personnel and Communications	828
		Assessment	829
		Backups and Offsite Storage	829

		Software Escrow Arrangements		833
		External Communications		833
		Utilities		834
		Logistics and Supplies		834
		The state of the s		834
		Recovery vs. Restoration Training, Awareness, and Documentation		835
		Testing and Maintenance		836
		Read-Through Test		836
		Structured Walk-Through		837
		Simulation Test		837
		Parallel Test		837
		Full-Interruption Test		837
		Maintenance		837
		Summary		838
		Exam Essentials		838
		YSTT . T 1		839
		p : 0 :		840
				0.10
Chapter	19	Investigations and Ethics		845
		Investigations		846
FOS		Investigation Types	18	846
		Evidence		849
		Investigation Process		853
		Major Categories of Computer Crime		857
		Military and Intelligence Attacks		857
		Business Attacks		858
		Financial Attacks		859
		Terrorist Attacks		859
		Grudge Attacks		859
		Thrill Attacks		861
		Ethics The		861
		(ISC) ² Code of Ethics		862
		Ethics and the Internet		862
		Summary		864
		Exam Essentials		864
		Written Lab		865
		Review Questions		866
Chapter	20	Software Development Security		871
		Introducing Systems Development Controls		872
		Software Development		872
		Systems Development Lifecycle		878
		Lifecycle Models		881

	Gantt Charts and PERT	887
	Change and Configuration Management	888
	The DevOps Approach	889
	Application Programming Interfaces	890
	Software Testing	891
	Code Repositories	893
	Service-Level Agreements	894
	Software Acquisition	894
	Establishing Databases and Data Warehousing	895
	Database Management System Architecture	896
	Database Transactions	899
	Security for Multilevel Databases	901
	Open Database Connectivity	903
	NoSQL	904
	Storing Data and Information	904
	Types of Storage	905
	Storage Threats	905
	Understanding Knowledge-Based Systems	906
	Expert Systems	907
	Machine Learning	908
	Neural Networks	908
	Security Applications	909
	Summary	
	Exam Essentials	909
	Written Lab	909
	Review Questions	910
	Review Questions	911
Chapter 21	Malicious Code and Application Attacks	915
	Malicious Code	916
	Sources of Malicious Code	916
	Viruses Wilder Viruses Viruse Viruses Viruse Viruse Vi	917
	Logic Bombs	923
	Trojan Horses Landard of Surgado	924
	Worms	925
	Spyware and Adware	928
	Zero-Day Attacks	928
	Password Attacks	929
	Password Guessing	929
	Dictionary Attacks	930
	Social Engineering	931
	Countermeasures	932
	Application Attacks	933
	Buffer Overflows	933
	Time of Check to Time of Use	934

Contents xxix

		Back Doors	934
		Escalation of Privilege and Rootkits	935
		Web Application Security	935
		Cross-Site Scripting	935
		Cross-Site Request Forgery	936
		SQL Injection	937
		Reconnaissance Attacks	940
		IP Probes	940
		Port Scans	940
		Vulnerability Scans	941
		Masquerading Attacks	941
		IP Spoofing	942
		Session Hijacking	942
904		Summary	942
		Exam Essentials	943
		Written Lab	944
		Review Questions	945
		Understanding Knowledge-Reed Systems	
Appendix	A	Answers to Review Questions	949
		Chapter 1: Security Governance Through Principles	
		and Policies	950
		Chapter 2: Personnel Security and Risk Management	
		Concepts	951
		Chapter 3: Business Continuity Planning	952
		Chapter 4: Laws, Regulations, and Compliance	954
		Chapter 5: Protecting Security of Assets	956
		Chapter 6: Cryptography and Symmetric Key Algorithms	958
		Chapter 7: PKI and Cryptographic Applications	960
		Chapter 8: Principles of Security Models, Design, and	
		Capabilities	961
		Chapter 9: Security Vulnerabilities, Threats, and	
		Countermeasures	963
		Chapter 10: Physical Security Requirements	965
		Chapter 11: Secure Network Architecture and Securing	
		Network Components	966
		Chapter 12: Secure Communications and Network Attacks	968
		Chapter 13: Managing Identity and Authentication	969
		Chapter 14: Controlling and Monitoring Access	971
		Chapter 15: Security Assessment and Testing	973
		Chapter 16: Managing Security Operations	975
		Chapter 17: Preventing and Responding to Incidents	977
		Chapter 18: Disaster Recovery Planning	980

	Chapter 19: Investigations and Ethics	981
	Chapter 20: Software Development Security	983
	Chapter 21: Malicious Code and Application Attacks	984
Appendix B	Answers to Written Labs	987
	Chapter 1: Security Governance Through Principles and Policies	988
	Chapter 2: Personnel Security and Risk Management	200
	Concepts	988
	Chapter 3: Business Continuity Planning	989
	Chapter 4: Laws, Regulations, and Compliance	990
	Chapter 5: Protecting Security of Assets	991
	Chapter 6: Cryptography and Symmetric Key Algorithms	991
	Chapter 7: PKI and Cryptographic Applications	992
	Chapter 8: Principles of Security Models, Design, and Capabilities	992
	Chapter 9: Security Vulnerabilities, Threats, and	772
	Countermeasures	993
	Chapter 10: Physical Security Requirements	994
	Chapter 11: Secure Network Architecture and Securing	774
	Network Components	994
	Chapter 12: Secure Communications and Network Attacks	995
	Chapter 13: Managing Identity and Authentication	996
	Chapter 14: Controlling and Monitoring Access	996
	Chapter 15: Security Assessment and Testing	997
	Chapter 16: Managing Security Operations	997
	Chapter 17: Preventing and Responding to Incidents	998
	Chapter 18: Disaster Recovery Planning	999
	Chapter 19: Investigations and Ethics	999
	Chapter 20: Software Development Security	1000
	Chapter 21: Malicious Code and Application Attacks	1000
Index		1001

Contents

XXXI