MCA(2 Years) Programme Structure: 2020

SEM	CODE	COURSE TITLE	CREDITS	REMARKS
Bridge Courses	CSC01	Computer Fundamentals	3	Any two courses as advised by the Department, as per clause H.
	CSC02	Programming and Problem Solving using C	4	
	CSC03	Applied Operating Systems	3	
	CSC04	Information Systems	3	
I	CSC11	Digital Logic and Computer Architecture	3	Periods/Week: ~24 Credits: ~20
	CSC12	Discrete Mathematics	3	
	CSC13	Algorithmics and Program Design	3	
	CSC14	Database Management Systems	3	
	CSC15	Lab-I (APD)	2	
	CSC16	Lab-II (DBMS)	2	
	CBCSE17	CBCSE-I	4	
II	CSC21	Software Engineering	3	Periods/Week: ~31 Credits:~27
	CSC22	Object Oriented Programming	3	
	CSC23	Advanced Data Structures	3	
	CSC24	Operating Systems and Shell Programming	3	
	CSE25	Elective-I	4	
	CSC26	Lab-III (OOP)	2	
	CSC27	Lab-IV(ADS+SP)	2	
	CBCSE28	CBCSE-II	4	
	CBCSS29	CbcsS-I	3	
III	CSC31	Data Communication and Networks	3	Periods/Week: ~31 Credits: ~27
	CSC32	Artificial Intelligence	3	
	CSC33	Information Security	3	
	CSC34	Analysis and Design of Algorithms	3	
	CSE35	Elective-II	4	
	CSC36	Lab-V (AI)	2	
	CSC37	Lab-VI (ADA)	2	
	CBCSE38	CBCSE-III	4	
	CBCSS39	CbcsS-II	3	
IV	CSC41	Major Project	20	Periods/Week: 36 and Credits: 20
Summary: Core-Courses(12)+Elective(2)+Lab-Courses(6)+CBCS-Elective(3)+CBCS-Skill(2)+Major-Project (1)=26 Courses				

Bi-Track Specialization: Optional Model

Department Elective Courses for PG Students: L-T-P: 4-0-0 /3-0-2 (4 Credits)				
Specialization Track		**Advanced Computing**	**Informatics**	
II	CSE25	Advanced DBMS Computer Graphics Theory of Computation	Software Quality Assurance Decision Support Systems Software Project Management	Management Information Systems Data Mining and Warehousing Software Testing and Verification
III	CSE35	Distributed Systems Cryptography Compiler Design System Software Digital Image Processing	Soft Computing Cyber Security Cloud Computing Machine Learning Security Audit and Design	Eduinformatics Health Informatics Advanced Software Engineering Adhoc Networks Programming with Java
CBCS Courses for PG Students: L-T-P: 4-0-0/3-0-2 (4 Credits)				
I	CBCSE17	Statistical Computing	e-Business Systems	Human Computer Interaction
II	CBCSE28	Modelling and Simulation	Business Informatics	Social Informatics
III	CBCSE38	Numerical Optimization	IT Management	Multimedia Applications
CBCS (Ability/Skill Enhancement) Courses for PG Students: L-T-P: 2-0-2 (3 Credits)				
II	CBCSS29	Programming with Python	Mobile Applications	Portal Development
III	CBCSS39	Data Analytics with HADOOP	MATLAB Computations	Web Based Programming
NOTE:- Relevant CBCS courses, of minimum 3 credits, may also be chosen from other departments.				

CSC31: Data Communication and Computer Networks

LEARNING OUTCOMES

Identify the components required to build different types of networks.·
Choose the required functionality at each layer for a given application.
Identify solutions for each functionality at each layer.·
Trace the flow of information from one node to another node in the network.

1. **Data Communication and Networking Overview:** Communication Model; Data Communications; Data Transmission and Related Concepts – Guided Media, Unguided Media, Direct Link, Point-to-Point and Multipoint Guided Configuration, Simplex, Half-Duplex, and Full-Duplex Transmission, Frequency, Spectrum, Bandwidth; Time Domain and Frequency Domain Concepts; Analog and Digital Data Transmission; Transmission Impairments – Attenuation and Attenuation Distortion, Delay Distortion, Noise; Channel Capacity.
2. **Computer Networks and Reference Models:** Computer Networks and its Applications; Broadcast and Point-to-Point Networks; Personal Area Networks; LAN; MAN; WAN; Wireless Networks; Internetworks; Network Layers, Protocols, and Interfaces; Connection-Oriented and Connectionless Services. OSI Reference Model; TCP/IP Reference Model; Comparison of OSI and TCP/IP Models; Problems with OSI and TCP Models; Internet and its Usage; Internet Architecture; Connection-Oriented Networks – X.25, Frame Relay, and ATM; Ethernet; Wireless LANs – 802.11.
3. **Transmission Media:** Twisted Pair, Coaxial Cable, Optical Fiber; Wireless Transmission – Antennas, Terrestrial Microwave, Satellite Microwave, Broadcast Radio, and Infrared; Wireless Propagation; Line of-Sight Transmission. Communication Satellites – Geostationary Satellites, Medium-Earth Orbit Satellites, Low-Earth Orbit Satellites; Satellites versus Fiber.
4. **Data Link Layer:** Design Issues; Error Detection and Correction; Elementary Data Link Protocols – Unrestricted Simplex Protocol, Simplex Stop-and-Wait Protocol; Sliding Window Protocols – One-Bit Sliding Window Protocol, Protocol Using Go Back N, A Protocol Using Selective Repeat, Data Link Protocol Examples – High-Level Data Link Control (HDLC), Point-to-Point Protocol (PPP). Medium Access Control Sublayer – Static Channel Allocation in LANs and MANs; Dynamic Channel Allocation in LANs and MANs; Multiple Access Protocol – ALOHA (Pure and Slotted), Carrier Sense Multiple Access (CSMA) Protocols (Persistent and Nonpersistent), CSMA with Collision Detection, Collision-Free Protocols, Wireless LAN Protocols, etc.; Ethernet; Wireless LANS – 802.11 Protocol Stack, 802.11 Physical Layer, 802.11 MAC Sublayer Protocol, 802.11 Frame Structure, and Services; Bluetooth Architecture and Applications; Data Link Layer Switching.
5. **The Network and Application Layer:** Design Issues; Routing Algorithms – Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, etc. Congestion Control Algorithms; IP Protocol; IP Addresses; Subnets; Subnet Mask; Internet Control Protocols, Domain Name System (DNS); DNS Name Space; Name Servers, Electronic Mail – Architecture and Services, User Agent, Message Formats, Simple Male Transfer Protocol (SMTP), POP3; World Wide Web and Hyper Text Transfer Protocol.

REFERENCES

A. S. Tanenbaum: Computer Networks. PHI
William Stallings: Data and Computer Communications. Pearson
Behrouz A. Forouzan: Data Communications and Networking (SIE). TMH

CSC32: Artificial Intelligence

LEARNING OUTCOMES

Understand design of AI and Deep learning based systems and design AI based expert system.
Solve different AI puzzles such as Sudoku, 8-puzzle etc. in Prolog.
Build, train and apply fully connected deep neural networks.
To implement efficient recurrent neural networks for sequence based data.

1. **AI Techniques:** History, AI techniques, Problem solving using Search, Uninformed v/s Informed Search, Heuristic Search Techniques: Hill Climbing, Simulated Annealing, Best First Search: OR Graphs, Heuristic Functions, A* Algorithm, AND-OR Graphs, AO* Algorithm, Adversarial Search: Zero-sum perfect information Games, Optimal Decisions and Strategies in Games, Mini-max Algorithm, Alpha-beta Pruning, Solving game puzzles: NIM, Chess, Chinese Checkers, etc.
2. **Knowledge Representation & Reasoning:** Propositional logic, Inference in First order logic, Forward v/s Backward chaining, Resolution, Resolution-refutation; PROLOG: Logic Programming and Horn Clauses; CUT and FAIL operators, Built-in Goals, Negation, recursive Lists processing, built-in Functions, PROLOG programs for puzzles; KR methods, Weak Slot-and-Filler Structures: Semantic Nets, Frames; Semantic Web and ontologies, Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts.
3. **Connectionist Models:** Feed-forward, Feedback; Activation Functions; Loss functions; Different Models: McCulloch and Pitts Model; Feed-forward model: Perceptron Learning, Delta rule and error Backpropagation learning; Deep learning, CNN architecture, layers, and learning; Feedback architectures and learning: Hopfield Model and Memories, Hebbian Learning, Boltzmann Machines and Energy Computations, real-life applications.
4. **Recurrent Neural Network:** RNN architecture and learning; different models and their applications in sequence classification and text analytics, long short-term memory (LSTM), Gated recurrent Unit (GRU); Unsupervised learning with ANN: Competitive Learning, SOM: architecture, classifications, Implementation and training, Ensemble methods.
5. **Genetic Algorithm and Fuzzy Logic:** Encoding, fitness functions, genetic operators, reproduction, evolutionary strategies, Applications of GA; Fuzzy Logic: fuzzy sets: properties and operations; Fuzzy logic and fuzzy rules, Mamdani fuzzy rule inferencing mechanism, Fuzzy Systems, Neuro Fuzzy Systems, etc.

REFERENCES

Tom M. Mitchell: Machine Learning. McGraw Hill
E. Rich & K. Knight: Artificial Intelligence. TMH
Michael Nielsen: Neural Networks and Deep Learning (free online book)
Stuart Russel & Peter Norvig: Artificial Intelligence–A Modern Approach. Pearson
Padhy: Artificial intelligence and intelligent systems. Oxford University Press

CSC33: Information Security

LEARNING OUTCOMES

Articulate and perform principled security analysis, design, and implementations.
Elaborate and develop security policies and programs for security and BC-DR assurance.
Explain, differentiate, and evaluate different security architecture/models in place for security assurance.
Illustrate basic cryptographic techniques and their respective significance.
Devise customized programs for operations security and access control systems.

1. **Context, CBK, and Principles:** IT Security Importance and Opportunities; Multidisciplinary Approach; Contextualizing Information Security; IS Expertise & Business Systems. Security Management Practices: Security Architecture and Models; BCP; Law, Investigations, and Ethics; Physical Security; Operations Security; ACM Systems and Methodology; Cryptography; Telecommunications, Network and Internet Security; and Application Development Security; Twelve Security Principle and CIA triad.
2. **Security Management and BC-DRP: Security Policies:** Programme-Level, Programme-Framework, Issue-Specific and System-Specific Policies; Development and Management of Security Policies: Security Objectives, Operational Security and Policy Implementation; Policy Support Documents Regulations; Standards Taxonomy; Risk Analysis and Management; Responsible for Security? Business Continuity Plan; Disaster Recovery Planning: Identifying Recovery Strategies, Shared-Site Agreements, Alternate Sites, Additional Arrangements, Testing DRP.
3. **Security Architecture and Models: Defining TCB:** Rings of Trust; Protection Mechanisms in a TCB: System Security Assurance Concepts, Goals of Security Testing and Formal Security Testing Models; TCSE: Minimal, Discretionary, Mandatory and Verified Protection; Trusted Network Interpretation and TCSEC; Comparing ITSEC and TCSEC & ITSEC; CTCPEC, FCITS; CI Models: Bell-LaPadula Model, Biba Integrity Model and Advanced Models; PPO: SFR, EAL and The CEL**.**
4. **Cryptography:** Cryptography Needs and Significance, Terms and Concepts: Cyphertext, Cryptanalysis, Cryptosystem, Message Digest etc; STE and Substitution; Digesting Data; Digital Certificates, Certification and Envelop; Symmetric and Symmetric Cryptography; Root, Private and Public; Digital Cryptography – Hashing Functions, Block Ciphers and Implementation of PPK cryptography.
5. **Operations Security and Access Control Systems:** Operations Security Principles; Operations Security Process Controls; Operations Security Controls in Action; Information Owner, Discretionary Access Control, ACL, MAC, RAC; Principles of Authentication: The Problems with Passwords, Multifactor Authentication, Biometrics, Single Sign-On, Kerberos and Federated Identities; Remote User Access and Authentication.

REFERENCES

M. Merkow & J. Breithaupt: Information Security - Principles and Practices. Pearson
M. E. Whitman & H. J. Mattord: Principles of Information Security. CENGAGE
M. Palmer: Guide to Operating Systems Security. CENGAGE

CSE34: Analysis and Design of Algorithms

LEARNING OUTCOMES

Lean Asymptotic notation for representing the time complexity of an algorithm in order notations.
Learn various algorithm development approaches such as divide and Conquer, Dydnamic Programmin, Greedy etc.
To Device different algorithms using various approaches for well known problems.
Lean the concept of Intractable problems such as NP, NP Complete, NP Hard etc.

1. **Algorithms Analysis and Divide and Conquer Approach:** Time Complexity, Complexity Representation using Order Notations: Big-o (O), Theta (Θ), Big-Omega (Ω), Small-o (o) and Small-Omega (ω) Notations; Properties of Complexity Notations; Limit Approach to Determine Order, Master Theorem. Algorithm Design Techniques (ADT): Divide and Conquer Approach – Divide, Conquer, and Combine Steps; Design and Analysis of Binary Search (Recursive and Non-recursive), Merger Sort, Quicksort, and Strassen‘s Matrix Multiplication Algorithms.
2. **Dynamic Programming Approach:** Introduction to Dynamic Programming; Difference Between Divide-and- Conquer and Dynamic Programming Approaches; Binomial Coefficient Finding using Dynamic Programming; Dynamic Programming and Optimization Problems: Chained Matrix Multiplication and Longest Common Subsequence Problems; Travelling Salesman Problem.
3. **Greedy Approach:** Introduction to Greedy Approach; Components of Greedy Approach: Selection Procedure, Feasibility Check, and Solution Check; Minimum Spanning Tree Generation: Prim‘s and Kruskal‘s Algorithms; Dijkstra‘s Algorithm for Single-Source Shortest Paths; Scheduling: Single Server and Multi-Server Scheduling, Scheduling with Deadlines; Huffman Code; The Knapsack Problem (Greedy Approach vs Dynamic Programming): 0-1 Knapsack and Fractional Knapsack Problems.
4. **Backtracking Approach:** Introduction to Backtracking; Backtracking Technique: State Space Tree, Promising and Non-Promising Nodes, Pruned State Space Tree; Backtracking Algorithms for n-Queens, Sum-of-Subsets, Graph Coloring, and 0-1 Knapsack Problems.
5. **Branch-and-Bound Method and Intractable Problems:** Introduction to Branch-and-Bound Method; Solving 0-1 Knapsack Problem using Branch-and-Bound Method: Breadth-First Search with Branch-and- Bound Pruning, Best-First Search with Branch-and-Bound Pruning; Solving Traveling Salesman Problem using Branch-and-Bound Method. Intractable Problems: NP-hard and NP-complete problems, Some examples of NP hard and NP complete Randomized Algorithm with examples

REFERENCES

R. Neapolitan & K. Naimipour: Foundations of Algorithms. Jones & Bartlett
T. H. Cormen etc.: Introduction to Algorithms. PHI
E. Horowitz, S. Sahani, and S. Rajasekaran: Fundamentals of Computer Algorithms. Galgotia

CSC36: Lab-IV (AI)
Implementation of at least ONE specific assignment concerning each of the following: 1. Puzzle solving in PROLOG: 8-queens, Sudoku, 8-puzzle, etc. 2. Design rule based expert system for theorem proving. 3. Implement Fuzzy logic based expert system. 4. Implement Transfer Learning using ResNet50 and CIFAR-10. 5. Implement a hand written digit recognizer using FFNN for MNIST dataset. 6. Implement an image classifier using CNN for ImageNet dataset. 7. Implement sequence data classifier using a long short-term memory (LSTM) network for Japanese Vowels dataset. 8. Implement sequence to sequence model using GRU. 9. Implemeting a regression model. 10. Implement optimization functions using GA.
CSC37: Lab-VI(ADA)
Implementation of at least ONE specific assignment concerning each of the following: **1.** Implementation of various divide and conquer algorithms. **2.** Implementation of the dynamic programming based algorithms. **3.** Implementation of the algorithms based on greedy approach. **4.** Implementation of the algorithms based on backtracking approach. **5.** Implementation of the algorithms based on branch and bound approach.

(Remark: Detailed syllabus of some Electives and CBCSE/CBCSS courses shall be designed and shared whenever floated for teaching – after BOS approval.)

CSE35.9: Elective-II: Machine Learning

LEARNING OUTCOMES

Understand the concept of machine leaning.
Understand the various types, technologies and standard involve in machine learning.
Able to use different machine learning techniques for classification and regression problems.
Understand the applications of the various machine learning techniques.

1. **Machine Learning and applications**: Machine Learning, Applications of ML, Intelligent Systems, Why Machine Learning, Problems Machine Learning Can Solve, Knowing, Your Task and Knowing Your Data, Types of Learning: Supervised, Unsupervised, and Reinforcement Learning, Decision Tree learning, Bayesian Learning and natural language processing.
2. **Connectionist Models/ANN:** Foundations for Connectionist Networks, Different Architectures and Output Functions: Feed-forward, Feedback, Recurrent Networks, Activation Functions; Different Models: MacCulloch and Pitts Model, Hopfield Model and Memories, Boltzmann Machines and Energy Computations, Learning Problems and Issues in feed-forward model, Supervised learning, Perceptron Learning, Delta rule and Backpropagation Learning. Supervised Machine Learning Algorithms: k-Nearest Neighbors, Linear Models, Naive Bayes Classifiers, Decision Trees, Ensembles of Decision Trees, Kernelized Support Vector Machines, Neural Networks, Deep Learning.
3. **Unsupervised Learning with ANN**: Competitive Learning, Hebbian Coincidence Learning, Attractor Networks, SOM, Adaptive Resonance Theory (ART): Architecture, classifications, Implementation and training, Introduction to Deep learning and Ensemble methods. Types of Unsupervised Learning, Challenges in Unsupervised Learning.
4. **Genetic Algorithm and Applications:** Introduction to genetic algorithms (GA), encoding, fitness functions, genetic operators, reproduction, evolutionary strategies, Applications of GA in Data Mining, Travelling Salesman problem, differential evolution, co-evolution, multi-objective GA (MOGA), Neuro-Genetic hybrid algorithm; Swarm Intelligence: Introduction, Swarm Based versus Population based techniques, Particle Swarm Optimization, Ant Colony Optimization.
5. **Machine Learning with python:** Colab Notebook, NumPy, SciPy, matplotlib, pandas, mglearn, Classifying Iris dataset, Model Evaluation and Improvement: Cross-Validation, Cross-Validation in scikit-learn, Benefits of Cross-Validation, Stratified k-Fold Cross-Validation and Other Strategies, Grid Search, Overfitting the Parameters and the Validation Set, Grid Search with Cross-Validation, Evaluation Metrics and Scoring: Keep the End Goal in Mind, Metrics for Binary Classification, Metrics for Multiclass Classification, Regression Metrics, Evaluation Metrics in Model Selection**.**

REFERENCES

Tom M. Mitchell: Machine Learning. McGraw Hill
A. C. Müller & S. Guido: Introduction to Machine Learning with Python. O'Reilly
S. Rakasekharan & G. A. Vijayalakshmi: Neural Networks, Fuzzy Logic and Genetic Algorithms. PHI
S. Russel & P. Norvig: Artificial Intelligence–A Modern Approach. Pearson

CSE35.14: Elective-II: Ad-Hoc Networks

LEARNING OUTCOMES

Understand the concept of ad-hoc and sensor networks, their applications and network architectures.
Understand the various types, technologies and standard involve in Ad-hoc networks.
Understand the Principles and QoS in routing of mobile Ad-Hoc Networks with security constraints.
Set up and evaluate measurements of protocol performance in different types of networks.

1. **Adhoc Wireless Networks:** Cellular and Ad Hoc Wireless Networks , Applications of Ad Hoc Wireless Networks, Computing Emergency Operations Wireless Mesh Networks, Wireless Sensor Networks, Hybrid Wireless Networks, Issues in Ad Hoc Network, Medium Access Scheme, Routing, Multicasting , Transport Layer Protocols, Quality of Services, Addressing and Service Discovery, Energy Management, Scalability, Ad Hoc Wireless internet.
2. **Body, Personal and Local Ad hoc Wireless Networks**: Mobile Ad-hoc –Body Area Network, Personal Area Network and Wireless Local Area Network; Technologies for Ad-hoc networks, IEEE 802.11 Architecture and Protocols – EEE 802.11 DCF, EEE 802.11 RTS/CTS; IEEE 802.16 Standard, A technology for WBAN and WPAN –Bluetooth, A Bluetooth Network, Bluetooth data transmission.
3. **Multicasting Techniques in Mobile Ad-hoc Networks:** Multicast protocols in wired Networks-Shortest path Multicast Tree, Core based trees Multi Cast Protocols, Multicast Protocols in Mobile Ad-hoc Networks- On-Demand Multicast Routing Protocol(ODMRP), Multicast Ad-hoc on-demand Distance Vector Routing Protocol (Multicast AODV), Forwarding Group Multicast Protocol(FGMP) , Core-Assisted Mesh Protocol.
4. **Quality of Service in Mobile Ad-Hoc Networks** : Operating Principles, Routing in Mobile Ad-hoc Networks, Routing with Quality of service Constraints, QoS Routing in Ad-hoc Networks, QoS Routing with Security Constraints .
5. **Cross Layer Design and Integration** -Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective, Co-operative networks:- Architecture, methods of co-operation, co-operative antennas, Integration of ad hoc network with other wired and wireless networks.

REFERENCES

Mohammad Ilyas: The Handbook of Ad Hoc Wireless Networks. CRC press
C. S. R. Murthy & B. S. Manoj: Ad Hoc Wireless Networks: Architectures and Protocols. Pearson
C. E. Perkins: Ad hoc Networking. Addison-Wesley
I. S. S. Basagni, M. Conti, and S. Giordano: Mobile Ad Hoc Networking. Wiley

CBCSE39.3: Web Based Programming	

LEARNING OUTCOMES

Understand core concepts of J2EE programming.
Ability to J2EE concepts to real-world enterprise application development
Learn the concepts of Servlets, Java Server Pages, Database Connectivity, Enterprise Java Beans, and JavaMail APIs.

1. **J2EE Overview & Multi-tier Architecture:** Overview of J2SE, J2EE, Advantages of Java, Birth of J2EE, Why J2EE; Distributed Systems, The Tier, J2EE Multi-tier architecture, Implementation of Client-tier, Web-tier, EJB-tier, and EIS-tier, Challenges; J2EE best practices: Enterprise Application Strategy, The Enterprise Application - Client, Session Management, Web-tier and JSPs, EJB-tier, MVC, The Myth of Using Inheritance, Maintainable Classes, Performance Enhancement, Power of Interfaces, Threads, and Notification
2. **Java Servlets & JDBC:** Overview of HTML, XML, and XHTML, Java and XML, Parsing XML, Java Servlets and CGI Programming, A Simple Java Servlet, Anatomy of a Java Servlet, Life Cycle of the Servlet, Deployment Descriptor, Reading data from client, reading HTTP request headers, working with cookies, Tracking sessions. Overview of JDBC, JDBC Drivers, JDBC Packages, JDBC Process, Database Connection, Statement, ResultSet, Transaction Processing, Servlet program with JDBC.
3. **Java Server Pages:** Overview of JSP, JSP versus Servlet, JSP Tags: Variables and Objects, Directives, Scripting Elements, Standard Actions, Implicit Objects, Scope, Java Server Pages with Beans, Tomcat, User Sessions, Cookies, Session Objects, JSP with JDBC, Creating Custom JSP Tag Libraries.
4. **Enterprise Java Beans:** The EJB Container, EJB Classes, EJB Interfaces, Deployment Descriptions: Anatomy, Environment elements, referencing EJB, Sharing resources, Security elements, Query elements, Relationship elements, Assembly elements. Session Java Beans - stateless vs stateful, Entity Java Beans - Container-managed persistence, Bean-managed persistence. Message-driven Beans, JAR, WAR, EAR Files.
5. **JavaMail, CORBA and RMI:**JavaMail API and Java Activation Framework, Protocols, Exceptions, Send Email Message, Retrieving Email Messages, Deleting Email Message. CORBA : The Concept of Object Request Brokerage, Java IDL and CORBA, The IDL Interface. Java RMI: Remote Method Invocation Concept, Server Side, Client Side.

REFERENCES

Jim Keogh: J2EE : The Complete Reference. Mc Graw Hill
H. Schildt: Java 2: The Complete Reference. Mc Graw Hill
Kogent Solutions Inc.: Java Server Programming Java EE 7 (J2EE 1.7), Black Book, Dreamtech Press
Subrahmanyam Allaramaju et al.: Professional JSP J2EE 1.3 Edition. Wrox Press
K. Qian et al.: Java Web Development Illuminated. Narosa
Robert W. Sebesta: Programming the World Wide Web. Pearson