SYLLABUS

SCHEME OF EXAMINATION

B. Tech- 4th Year | **Semester: 7th**

Branch: Computer Science and Engineering (Data Science)

S.N.	Subject Name	Subject Code	Periods per week			Scheme of Exam			Total Marks	Credit L+(T+P)/2
						Theory/Practical				
			L	T	P	ESE	CT	TA		
1	Digital Image Processing	CS110701	2	1	-	100	20	30	150	3
2	Advanced R Programming	CS102702	2	1	-	100	20	30	150	3
3	Deep Learning	CS110703	3	0	-	100	20	30	150	3
4	Professional Elective –III	Refer Table -II	3	0	-	100	20	30	150	3
5	Open Elective – II	Refer Table-I	3	0	-	100	20	30	150	3
6	R Programming Lab	CS102791	-	-	2	25	-	25	50	1
7	Deep Learning Lab	CS110792	-	--	2	25	-	25	50	1
8	Capstone Project Phase -1	CS102793	-	-	4	50	-	50	100	2
9	Industrial Training (VT)	CS102794	-	-	2	-	-	25	25	1
10	Universal Human Value and Professional Ethics	CS100795	-	-	-	-	-	25	25	-
Total			**15**	**1**	**8**	**600**	**100**	**300**	**1000**	**20**

Table-I: Professional Elective – III [7th Sem]

Sl. No.	Board of Studies (BOS)	Courses (Subject)	Course Code
1	Computer Science and Engg.	Internet and Web Technology	CS102721
2	Computer Science and Engg.	Natural Language Processing	CS110722
3	Computer Science and Engg.	Object Oriented Database Management System	CS111723
4	Computer Science and Engg.	AI in Gaming	CS114724
5	Computer Science and Engg.	Industrial IOT	CS115725

Table-II: Open Elective – II [7th Sem]

Sl. No.	Board of Studies (BOS)	Courses (Subject)	Course Code
1	Computer Science and Engg.	Advance Statistical Methods	CS100741
2	Computer Science and Engg.	Enterprise Resource Planning	CS100742

SYLLABUS
B. Tech. Seventh Semester- Computer Science & Engineering (Data Science)

Subject Code CS102701	Digital Image Processing	L = 3	T = 2	P = 0	Credits = 3
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours

Course Objectives	Course Outcomes
The objective of the course to: **1.** To introduce the fundamentals of deep learning and the main research activities in this field. **2.** To learn architectures and optimization methods for deep neural network training.	**Students will be able to:** **CO1** Understand the fundamentals of deep learning and the main research activities in this field **CO2** Remember architectures and optimization methods for deep neural network training **CO3** Implement, apply and test relevant learning algorithms in TensorFlow **CO4** Critically evaluate the method's applicability in new contexts and construct new applications

Unit – 1 : Introduction: Digital Image Processing, Fundamental Steps In Image Processing, Components Of Digital Image Processing Systems, Elements Of Visual Perception, Image Formation Model, Image Sampling And Quantization, Relationship Between Pixels- Neighborhood, Adjacency Connectivity, Regions, Boundaries And Distance Measures.	**CO 01** **08 Hrs**
Unit- 2 Image Enhancement: Enhancement By Point Processing, Sample Intensity Transformation, Histogram Processing, Image Subtraction, Image Averaging, Spatial Filtering –Smoothing Special Filters, Sharpening Spatial Filters, Frequency Domain- Fourier Transform, Low Pass, High Pass, Laplacian, Homomorphic Filtering.	**CO 02** **08 Hrs**
Unit- 3 Image Segmentation: Detection of Discontinuities- Point, Line And Edge Detection, Edge Linking And Boundary Detection, Thresholding, Region-Based Segmentation- Region Growing, Region Splitting And Merging. Use of Motion in Segmentation- Spatial Techniques and Frequency Domain Technique.	**CO 03** **08 Hrs**
Unit- 4 Image Compression: Coding Redundancy, Inter Pixel Redundancy, Fidelity Criteria, Image Compression Models, Error Free Compression, Lossy Compression, Variable Length Coding, Bit Plane Coding, Lossless Predictive Coding, Image Compression Standards, Real Time Image Transmission, Jpeg and Mpeg.	**CO 04** **08 Hrs**
Unit – 5 Color Image Processing: Color Models, Pseudo Color Image Processing, Color Transformation, Smoothing and Sharpening, Image	**CO 05**

Segmentation Based On Color	**08 Hrs**

Text Books:

S. No.	Title	Author(s)	Publisher
1	DIGITAL IMAGE PROCESSING	R. C. GONZALEZ, R. E. WOODS	PEARSON EDUCATION
2	DIGITAL IMAGE PROCESSING	W.K. PRATT	WILEY-INTERSCIENCE

SYLLABUS
B. Tech. Seventh Semester- Computer Science & Engineering (Data Science)

Subject Code CS102702	Advanced R Programming	L = 3	T = 2	P = 0	Credits = 3
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours

Course Objectives	Course Outcomes
1. Learn Fundamentals of R 2. Covers how to use different functions in R, how to read data into R, accessing R packages, writing R functions, debugging, and organizing data using R functions. 3. Cover the Basics of statistical data analysis with examples. 4. The whole syllabus will give an idea to collect, compile and visualize data using statistical functions.	After the completion of this course, the students will be able to: 1. Understand the basics of Fundamentals of R. 2. Understands the loading, retrieval techniques of data. 3. Understand how data is analysed and visualized using statistic functions.

Unit I Introduction to Vector, Matrix and Data Frames Introduction to vectors, Vector recycling, Slicing and indexing a vector in R, Extracting elements from a vector, Changing the dimensions of an object in R, Creating a matrix in R, Indexing an element from a matrix, Slicing a matrix in R, Matrix arithmetic, Matrix operations, Categorical data, Factors in R, Lists in R, Introduction , Creating a data frame in R, The Tidy verse Package, Data import in R, Importing a CSV in R Creating data frames, Getting a sense of your data frame, Indexing and slicing a data frame in R, Data frame operations, extending a data frame in R	**CO 01 08 Hrs**
Unit II Manipulating data Introduction, Data transformation with R- the Dplyr package, Sampling data with Dplyr package, Using the pipe operator in R, Manipulating Data, Tidying data in R-gather() and separate(), unite(), spread(), Tidying data . Introduction to data visualization, introduction to ggplot2, variables: revisited, Building a histogram with ggplot2, building a bar chart with ggplot2, Building a box and whiskers plot with ggplot2, Building a scatterplot with ggplot2	**CO 02 08 Hrs**
Unit III Exploratory Data analysis Population vs. sample, Mean, median, mode, Skewness, Variance, standard deviation and coefficient of variability, Covariance and Correlation	**CO 03 08 Hrs**
Unit IV Hypothesis Testing Distribution, Standard Error and Confidence	**CO 04**

Intervals, Hypothesis, Type I and Type II errors, Test for the mean-population variance known, The P-value, Comparing two means-Independent Samples	**08 Hrs**
Unit V Linear Regression Analysis The linear regression model, Correlation vs regression, Correlation vs regression, Geometrical representation Decomposition of variability: SST, SSR, SSE, R-Squared	**CO 05 08 Hrs**

Text Books:

S. No.	Title	Author(s)	Publisher
1	R Programming for Beginners	Sandip Rakshit	McGraw Hill Education (India)
2	Data Analytics using R	Seema Acharya	McGrawHill Education (India)

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Tutorials Point (I) simply easy learning	Online Tutorial Library (2018)	https://www.tutorialspoint.com/r/r_tutorial.pdf
2	R for Dummies	Andrie de Vries, Joris Meys	John Wiley and Sons

SYLLABUS

B. Tech. Seventh Semester- Computer Science & Engineering (Data Science)

Subject Code CS110703	Deep Learning	L = 3	T = 2	P = 0	Credits = 3
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours

Course Objectives	Course Outcomes
The objective of the course to: **3.** To introduce the fundamentals of deep learning and the main research activities in this field. **4.** To learn architectures and optimization methods for deep neural network training.	**Students will be able to:** **CO5** Understand the fundamentals of deep learning and the main research activities in this field **CO6** Remember architectures and optimization methods for deep neural network training **CO7** Implement, apply and test relevant learning algorithms in TensorFlow **CO8** Critically evaluate the method's applicability in new contexts and construct new applications

UNIT 1 Introduction: History of Deep Learning, McCulloch Pitts Neuron, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed Forward Neural Networks, Back propagation	**CO 01 08 Hrs**
UNIT 2 Activation Functions & Parameters: Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, Principal Component Analysis and its interpretations, Singular Value Decomposition, Parameters v/s Hyper-parameters	**CO 02 08 Hrs**
UNIT 3 Auto-Encoders & Regularization: Auto encoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Encoder Decoder Models, Attention Mechanism, Attention over images, Batch Normalization	**CO 03 08 Hrs**
UNIT 4 Deep Learning Models: Introduction to CNNs, Architecture, Convolution/pooling layers, CNN Applications, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. Introduction to RNNs, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs	**CO 04 08 Hrs**
UNIT 5 Deep Learning Applications: Image Processing, Natural Language Processing, Speech recognition, Video Analytics	**CO 05 08 Hrs**

SYLLABUS
B. Tech. Seventh Semester- Computer Science & Engineering (Data Science)

Text Books:

S. No.	Title	Author(s)	Publisher
1	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courville	The MIT Press
2	Learning deep architectures for AI	Bengio, Yoshua	Now Publishers

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Deep Learning	Rajiv Chopra	Khanna Book Publishing

Alternative NPTEL/SWAYAM Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Deep Learning	Prof. Mitesh M. Khapra	IIT Ropar
2	Deep Learning	Prof. Prabir Kumar Biswas	IIT Kharagpur

Web Reference:

https://nptel.ac.in/courses/106/106/106106184/
https://www.coursera.org/specializations/deep-learning

SYLLABUS
B. Tech. Seventh Semester- Computer Science & Engineering (Data Science)

Subject Code CS110792	Deep Learning Lab	L =	T = 0	P = 2	Credits = 1
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	25	-	25	50	3 Hours

Course Objectives	Course Outcomes
• To illustrate simple neural networks and deep neural networks. • To interpret the model results and analyze the accuracy of the model. • To explain different preprocessing operations on structured data or on unstructured data. • To explain how to predict the results using a trained model.	• Perform different pre-processing operations on structured or unstructured data • Design neural network layers for various learning problems. • Demonstrate binary as well as multi-class classification problems. • Interpret the model results and analyze the performance of the model. • Apply statistical concepts and perform Exploratory Data Analysis. • Implement, train, and validate their own neural network

Guidelines for Laboratory Conduction:

- Prior knowledge of Linear Algebra, Probability Theory, Machine Learning, Artificial Neural Network, Python programming language is essential.
- Operating System recommended: - 64-bit Open-source Linux or its derivative
- Recommended tools for the implementation: Python, OpenCV, TensorFlow, Pytorch, MATLAB, etc.
- Use of the Anaconda platform is encouraged.

1. Write a program to generate following logic functions using McCulloch-Pitts neuron and appropriate values for weights, bias and threshold
   a) AND logic function
   b) OR logic function
   c) NOT logic function
   d) NOR logic function
   e) XOR logic function

2. Write a program to build a logistic regression classifier with a Neural Network mindset. Consider following guidelines.
   a) Consider any convenient dataset (Cats dataset etc.) and pre-process the dataset.
   b) Define the appropriate model structure.

c) Evaluate the model performance.
d) Analyse the obtained results

3. Design a neural network (NN) model with one hidden layer for classification problems. Use Planar data set or any other suitable data set
   a) Implement a 2-class classification neural network with a single hidden layer.
   b) Use units with a non-linear activation function, such as tanh.
   c) Compute the cross-entropy loss.
   d) Implement forward and backward propagation.
   e) Evaluate the model performance.
   f) Analyse the results

4. Implement a multilayer perceptron (MLP) model for prediction such as house prices.
   a) Perform Exploratory Data Analysis
   b) Prepare dataset
   c) Build MLP model
   d) Evaluate Model performance
   e) Predict for test data

5. Build a Multiclass classifier using the CNN model. Use MNIST or any other suitable dataset.
   a) Perform Data Pre-processing
   b) Define Model and perform training
   c) Evaluate Results using confusion matrix

6. Design an object detection model using deep neural networks for simple objects.
   a) Select appropriate dataset and perform data pre-processing
   b) Define architecture in terms of layers
   c) Evaluate Model performance
   d) Label the object with appropriate text

7. Install OpenCV package on your system and perform following operations on images.
   a) Image Sharpening
   b) Edge Detection & Image Gradients
   c) Cropping
   d) Blurring
   e) Background Subtraction Method

8. Design and implement a CNN for Image Classification.
   a) Select a suitable image classification dataset (medical imaging, agricultural, etc.).
   b) Optimized with different hyper-parameters including learning rate, filter size, no. of layers, optimizers, dropouts, etc

9. Apply a pre-trained network and apply it to a new task using transfer learning.
   a) Use any three pre-trained models including AlexNet, GoogleNet, VGGNet, MobileNet, ResNet, DenseNet, etc.
   b) Fine-tune the hyper-parameters and compare their performance for a suitable

application.

10. Design RNN or its variant including LSTM or GRU.
    a) Select a suitable time series dataset. Example – predict sentiments based on product reviews
    b) Apply for prediction

11. Build a word2vec model for unstructured data.
    a) Use any unstructured text dataset
    b) Convert words into a representative vector of numerical values

12. Implement an artificial neural network on GPUs
    a) Implement ANN on GPUs.
    b) Deploy the model using Amazon SageMaker or other platforms available

13. Implement Auto-encoders for any of the task including.
    a) Data Compression
    b) Image de-noising
    c) Dimensionality reduction

14. Design and implement Deep Convolutional GAN to generate images of faces/digits from a set of given images.

Text Books:

S. No.	Title	Author(s)	Publisher
1	R Programming for Beginners	Sandip Rakshit	McGraw Hill Education (India)
2	Data Analytics using R	Seema Acharya	McGrawHill Education (India)

SYLLABUS

B. Tech. Seventh Semester- Computer Science & Engineering (Data Science)

Subject Code CS102791	R Programming Lab	L =	T = 0	P = 2	Credits = 1
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	25	-	25	50	3 Hours

Course Objectives	Course Outcomes
• Demonstrate use of basic functions • Create their own customized functions • Construct tables and figures for descriptive statistics • Learn to understand new data sets and functions by yourself • Work on built-in real-time cases for analysis and visualization	• Enable to build programming logic and thereby developing skills in programming • Clear understanding on how to organize data analyse data using real time example

List of Experiments.

1. Write a program to check whether a year (integer) entered by the user is a leap year or not?
2. Write an R program to find the sum of natural without formula using the if-else statement and while loop.
3. Write a program that prints the grades of the students according to the marks obtained. The grading of the marks should be as follows. Marks Grades 800-1000 A+, 700 – 800 A, 500 – 700 B+, 400-500 B, 150 – 400 C, Less than 150 D.
4. Write an R program to make a simple calculator that can add, subtract, multiply and divide using switch cases and functions.
5. Write a program to perform searching within a list (1 to 50). If the number is found in the list, print that the search is successful otherwise print that the number is not in the list. Program:
6. Create a list and data frame that stores the marks of any three subjects for 10 students. Find out the total marks, average, maximum marks and minimum marks of every subject.
7. Write the steps to import data from Excel to CSV files and apply data viewer functions like rm(),dim(),head(), tail(), sorting, filtering, searching to view few set of rows.
8. Write a program to create two 3 X 3 matrices A and B and perform the following operations:
    a. Transpose of the matrix.
    b. Addition.
    c. Subtraction
9. Write an R program to create a list containing strings, numbers, vectors and logical values and do the following manipulations over the list:
    a. Access the first element in the list
    b. Give the names to the elements in the list
    c. Add element at some position in the list

d. Remove the element
e. Print the fourth element
f. Update the third element

10. Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Create a histogram by suing appropriate arguments for the following statements:
    a. Assigning names, using the air quality data set
    b. Change colours of the Histogram
    c. Remove Axis and Add Labels to Histogram
    d. Change Axis limits of a Histogram
    e. Create a Histogram with density and Add Density curve to the Histogram
11. Design a data frame in R for storing about 20 employee details. Create a CSV file named "input.csv" that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis.
    a. Find the total number rows & columns
    b. Find the maximum salary
    c. Retrieve the details of the employee with maximum salary
    d. Retrieve all the employees working in the IT Department
    e. Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file "output.csv".
12. Create a dataset or table ['Smart Phone"] in an excel sheet that stores the mobile information [price, company name, model, Sale Percent] of five different companies. Store at least 20 rows. Write the scripts and find out the output for the following information.
    a. Maximum price of the mobile of each company
    b. Minimum price of mobile of each company
    c. Average price of mobile of each company
    d. Total Price of mobile of each company

Text Books:

S. No.	Title	Author(s)	Publisher
1	R Programming for Beginners	Sandip Rakshit	McGraw Hill Education (India)
2	Data Analytics using R	Seema Acharya	McGrawHill Education (India)

SYLLABUS
B. Tech. Seventh Semester- Computer Science & Engineering (Data Science)

Subject Code CS102721	Internet and Web Technology	L = 3	T = 2	P = 0	Credits = 3
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours

Course Objectives	Course Outcomes
1. Describe the important features of the Web and Web browser software 2. Evaluate e-mail software and Web-based e-mail services 3. Use FTP and other services to transfer and store data 4. Demonstrate the use of real-time chat and briefly describe the history of the wireless Internet 5. Create HTML documents and enhance them with browser extensions	Students will be able to: 1. Understand, analyze and apply the role of languages like HTML, DHTML, CSS, XML, Javascript, and web applications 2. Analyze a web page and identify its elements and attributes. 3. Create XML documents and XML Schema

UNIT-I INTRODUCTION TO INTERNET: Introduction, Evolution of Internet, Internet Applications, Internet Protocol -TCP/IP, UDP, HTTP, Secure Http(Shttp) Internet Addressing – Addressing Scheme – Ipv4 & IPv6, Network Byte Order, Domain Name Server and IP Addresses, Mapping . Internet Service Providers, Types Of Connectivity Such As Dial-Up Leaded Vsat Etc. Web Technologies: ThreeTier Web Based Architecture; Jsp, Asp, J2ee, .Net Systems	**CO _ __ Hrs**
UNIT-II HTML CSS AND SCRIPTING: HTML - Introduction, Sgml, Dtd(Document Type Definition, Basic Html Elements, Tags and usages, HTML Standards , Issues in HTML Dhtml: Introduction Cascading Style Sheets: Syntax ,Class Selector, Id Selector Dom (Document ObjectModel) & DSO (Data Source Object) Approaches To Dynamic Pages: Cgi, Java Applets, Plug Ins, Active X, Java Script –Java Script Object Model, Variables-Constant – Expressions, Conditions Relational Operators- Data Types – Flow Control – Functions & Objects-events and event handlers – Data type Conversion & Equality – Accessing HTML form elements	**CO _ __ Hrs**
UNIT-III XML: What is XML – Basic Standards, Schema Standards, Linking & Presentation Standards, Standards that build on XML, Generating XML data, Writing a simple XML File, Creating a Document type definition, Documents &Data ,Defining Attributes & Entities in the DTD ,Defining Parameter Entities & conditional Sections, Resolving a naming conflict, Using Namespaces, Designing an XML data structure,	**CO __ __Hrs**

Normalizing Data, Normalizing DTDS	
UNIT-IV INTERNET SECURITY & FIREWALLS: Security Threats From Mobile Codes, Types Of Viruses, Client Server Security Threats, Data & Message Security, Various electronic payment systems, Introduction to EDI, Challenges– Response System, Encrypted Documents And Emails,Firewalls: Hardened Firewall Hosts, Ip- Packet Screening, Proxy Application Gateways, Aaa (Authentication, Authorization And Accounting).	**CO _ __ Hrs**
UNIT-V WEBSITE PLANNING & HOSTING: Introduction, Web Page Lay-Outing, Where To Host Site, Maintenance Of Site, Registration Of Site On Search Engines And Indexes, Introduction To File Transfer Protocol, Public Domain Software, Types Of Ftp Servers (Including Anonymous),Ftp Clients Common Command. Telnet Protocol, Server Domain, Telnet Client, Terminal Emulation. Usenet And Internet Relay Chat.	**CO __ __Hrs**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Internet & Intranet Engineering	Daniel Minoli	TMH
2	Internet for Every One	Alexis Leon and Mathews Leon	Tech World

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Using HTML 4, XML and JAVA	Eric Ladd, Jim O'Donnel	Prentice Hall of India -1999
	Beginning Java Script	Paul Wilton	SPD Publications
	Frontiers of Electronics of Commerce	Ravi kalakota & Andrew B. Whinston	Addison Wesley

SYLLABUS

B. Tech. Seventh Semester- Computer Science & Engineering (Data Science)

Subject Code CS100741	Enterprise Resource Planning	L = 3	T = 0	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
• To know the basics of ERP and business modules of ERP. • To understand the key implementation issues of ERP. • To be aware of some popular products in the area of ERP. • To appreciate the current and future trends in ERP	• To know the basics of ERP • To understand the key implementation issues of ERP • To know the business modules of ERP • To be aware of some popular products in the area of ERP • To appreciate the current and future trends in ERP

Unit-I Introduction: Overview of enterprise systems ñ Evolution - Risks and benefits – Fundamental technology - Issues to be consider in planning design and implementation of cross functional integrated ERP systems. Introduction to SAP

Unit- II ERP Solutions and Functional Modules: Overview of ERP software solutions- Small, medium and large enterprise vendor solutions, BPR and best business practices - Business process Management, Functional modules.

Unit-III ERP Implementation: Planning Evaluation and selection of ERP systems - Implementation life cycle - ERP implementation, Methodology and Frame work- Training ñ Data Migration – People Organization in implementation-Consultants, Vendors and Employees.

Unit-IV Post Implementation: Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation. Emerging Trends on ERP: Extended ERP systems and ERP add-ons -CRM, SCM, Business analytics - Future trends in ERP systems-web enabled, Wireless technologies, cloud computing.

Unit V ERP and Related Technologies. ERP and Related Technologies. Business Process Reengineering (BPR). Management Information System (MIS). Executive Information System. Decision support System (DSS). Supply Chain Management (SCM) Other Related Technologies of SCM E-Procurement; E-Logistics; Internet Auctions; E-markets; Electronic Business Process Optimization; Business Objects in SCM; E commerce

SYLLABUS
B. Tech. Seventh Semester- Computer Science & Engineering (Data Science)

Text Books:

S. No.	Title	Author(s)	Publisher
1	ERP demystified	Alexis Leon	Tata McGraw-Hill,2008
2	Essentials of Business Process and Information System	Sinha P. Magal and Jeffery Word	Wiley India,2012

Reference Books:

S. No.	Title	Author(s)	Publisher
1	ERP and Supply Chain Management	Christian N. Madu	CHI**4**
2	Implementing SAP ERP Sales & Distribution	Glynn C. Williams	McGraw-Hill