JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF INFORMATION TECHNOLOGY

III Year – I SEMESTER

S.No	Course Code	Courses	L	T	P	Credits
1	IT3101	Advanced Data Structures	3	1	0	4
2	IT3102	Computer Networks	3	0	0	3
3	IT3103	Compiler Design	3	0	0	3
4	IT3104	Artificial Intelligence	3	0	0	3
5	PE3101	**Professional Elective -I** 1. Software Testing Methodologies 2. NoSQL Databases 3. Scripting Languages 4. Computer Graphics 5. R-Programming	3	0	0	3
6	IT3105	Design and Analysis of Algorithms	3	0	0	3
7	IT3106	Computer Networks & Compiler Design Lab	0	0	3	1.5
8	IT3107	AI Tools & Techniques Lab	0	0	3	1.5
9	MC3101	Employability Skills - II*	2	0	0	0
		Total	20	1	6	22

*Internal Evaluation through Seminar / Test conducted for 50 marks

III Year – II SEMESTER

S.No	Course Code	Courses	L	T	P	Credits
1	IT3201	Data Warehousing and Data Mining	3	0	0	3
2	OE3201	**Open Elective- I (Inter Disciplinary)**	3	0	0	3
3	IT3202	Web Technologies	3	0	0	3
4	PE3201	**Professional Elective II** (NPTEL/SWAYAM) **Duration: 12 Weeks Minimum** ***Course/subject title can't be repeated**	3	0	0	3
5	HS3201	Managerial Economics and Financial Accountancy	3	0	0	3
6	IT3203	Web Technologies Lab	0	0	3	1.5
7	IT3204	Data Mining Lab	0	0	3	1.5
8	PR3201	Industrial Training / Skill Development Programmes / Research Project in higher learning institutes	0	0	0	1
		Total	15	0	6	19

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III Year – II Semester		L	T	P	C
		3	0	0	3

DATA WAREHOUSING AND DATA MINING

Course Objectives:
- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools

Course Outcomes:

At the end of the course, the students will be able to:
- Design a Data warehouse system and perform business analysis with OLAP tools
- Apply suitable pre-processing and visualization techniques for data analysis
- Apply frequent pattern and association rule mining techniques for data analysis
- Apply appropriate classification techniques for data analysis
- Apply appropriate clustering techniques for data analysis

UNIT I

Data Warehousing, Business Analysis and On-Line Analytical Processing (OLAP): Basic Concepts, Data Warehousing Components, Building a Data Warehouse, Database Architectures for Parallel Processing, Parallel DBMS Vendors, Multidimensional Data Model, Data Warehouse Schemas for Decision Support, Concept Hierarchies, Characteristics of OLAP Systems, Typical OLAP Operations, OLAP and OLTP.

UNIT II

Introduction to Data Mining Systems, Knowledge Discovery Process, Data Mining Techniques, Issues, applications, Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT III

Frequent Pattern Analysis: Mining Frequent Patterns, Associations and Correlations, Mining Methods, Pattern Evaluation Method, Pattern Mining in Multilevel, Multi-Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

UNIT IV

Classification: Decision Tree Induction, Bayesian Classification, Rule Based Classification, Classification by Back Propagation, Support Vector Machines, Lazy Learners, Model Evaluation and Selection, Techniques to improve Classification Accuracy

UNIT V

Clustering: Clustering Techniques, Cluster analysis, Partitioning Methods, Hierarchical methods, Density Based Methods, Grid Based Methods, Evaluation of clustering, Clustering high dimensional data, Clustering with constraints, Outlier analysis, outlier detection methods.

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Text Books:

1) Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.
2) Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining, Pearson, 2016.

Reference Books:

1) Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
2) K.P. Soman, ShyamDiwakar and V. Ajay, ―Insight into Data Mining Theory and Practice‖, Eastern Economy Edition, Prentice Hall of India, 2006.
3) Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools and Techniques‖, Elsevier, Second Edition.

e-Resources:

1) https://www.saedsayad.com/data_mining_map.htm
2) https://nptel.ac.in/courses/106/105/106105174/
3) (NPTEL course by Prof.Pabitra Mitra) http://onlinecourses.nptel.ac.in/noc17_mg24/preview
4) (NPTEL course by Dr. Nandan Sudarshanam & Dr. Balaraman Ravindran) http://www.saedsayad.com/data_mining_map.htm

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III Year – II Semester		L	T	P	C
		3	0	0	3
	Open Elective –I				

Note: The student has to take any one **open elective course** offered in the other departments (or) SWAYAM/NPTEL courses offered by other than parent department. (12 week minimum).

Given below are some of the courses offered by NPTEL/SWAYAM

Electronics & Communication Engineering 1) Information Coding Theory 2) VLSI Design 3) Signals & Systems 4) Digital Signal Processing	**Mathematics** 1) Optimization Techniques 2) Computational Number Theory and Cryptography
Electrical and Electronics Engineering 1) Networking Analysis 2) Fuzzy Sets, Logic and Systems & Applications 3) Energy Management Systems and SCADA 4) Industrial Safety Engineering	**Civil Engineering** 1) Intelligent transportation engineering 2) Remote Sensing and GI 3) Engineering Mechanics 4) City and Metropolitan Planning 5) Sustainable Materials and Green Buildings
Mechanical Engineering 1) Industrial Automation and Control 2) Robotics 3) CAD 4) Mechatronics And Manufacturing Automation 5) Non Conventional Energy Resources	

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III Year – II Semester		L	T	P	C
		3	0	0	3
	WEB TECHNOLOGIES				

Course Objectives:

From the course the student will learn

- Translate user requirements into the overall architecture and implementation of new systems and Manage Project and coordinate with the Client
- Write backend code in PHP language and Writing optimized front end code HTML and JavaScript
- Understand, create and debug database related queries and Create test code to validate the applications against client requirement
- Monitor the performance of web applications & infrastructure and Troubleshooting web application with a fast and accurate a resolution

Course Outcomes:

- Illustrate the basic concepts of HTML and CSS & apply those concepts to design static web pages.
- Identify and understand various concepts related to dynamic web pages and validate them using JavaScript
- Outline the concepts of Extensible markup language & AJAX
- Develop web Applications using Scripting Languages & Frameworks
- Create and deploy secure, usable database driven web applications using PHP and RUBY

UNIT I

HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Html styles, Elements, Attributes, Heading, Layouts, Html media, Iframes Images, Hypertext Links, Lists, Tables, Forms, GET and POST method, HTML 5, Dynamic HTML.

CSS: Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms, The Box Model, Conflict Resolution, CSS3.

UNIT II

Javascript - Introduction to Javascript, Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions, Fundamentals of Angular JS and NODE JS Angular Java Script- Introduction to Angular JS Expressions: ARRAY, Objects, Strings, Angular JS Form Validation & Form Submission.

Node.js- Introduction, Advantages, Node.js Process Model, Node JS Modules, Node JS File system, Node JS URL module, Node JS Events.

UNIT III

Working with XML: Document type Definition (DTD), XML schemas, XSLT, Document object model, Parsers - DOM and SAX.

AJAX A New Approach: Introduction to AJAX, Basics of AJAX, XML Http Request Object, AJAX UI tags, Integrating PHP and AJAX.

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UNIT IV

PHP Programming: Introduction to PHP, Creating PHP script, Running PHP script. Working with variables and constants: Using variables, Using constants, Data types, Operators. Controlling program flow: Conditional statements, Control statements, Arrays, functions.

UNIT V

Web Servers- IIS (XAMPP, LAMP) and Tomcat Servers. Java Web Technologies-Introduction to Servlet, Life cycle of Servlet, Servlet methods, Java Server Pages.

Database connectivity – Servlets, JSP, PHP, Practice of SQL Queries.

Introduction to Mongo DB and JQuery.

Web development frameworks – Introduction to Ruby, Ruby Scripting, Ruby on rails, Design, Implementation and Maintenance aspects.

Text Books:
1) Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
2) Web Technologies, 1st Edition 7th impression, Uttam K Roy, Oxford, 2012.
3) Pro Mean Stack Development, 1st Edition, ELad Elrom, Apress O'Reilly, 2016
4) Java Script & jQuery the missing manual, 2nd Edition, David sawyer mcfarland, O'Reilly, 2011.
5) Web Hosting for Dummies, 1st Edition, Peter Pollock, John Wiley & Sons, 2013
6) RESTful web services, 1st Edition, Leonard Richardson, Ruby, O'Reilly, 2007

Reference Books:
1) Ruby on Rails Up and Running, Lightning fast Web development, 1st Edition, Bruce Tate, Curt Hibbs, Oreilly, 2006.
2) Programming Perl, 4th Edition, Tom Christiansen, Jonathan Orwant, O'Reilly, 2012.
3) Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech, 2009.
4) An Introduction to Web Design, Programming, 1st Edition, Paul S Wang, Sanda S Katila, Cengage Learning, 2003.

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III Year – II Semester		L	T	P	C
		3	0	0	3
	PROFESSIONAL ELECTIVE -II				

(NPTEL/SWAYAM) Course

Duration: 12 Weeks Minimum

*Course/subject title can't be repeated

12 Weeks NPTEL Courses by NPTEL/SWAYAM courses

1) Introduction to Industry 4.0 and Industrial Internet of Things
2) AI: Knowledge Representation and Reasoning
3) Synthesis of Digital Systems
4) Privacy and Security in Online Social Media
5) Block chain architecture design and use cases
6) Machine Learning for Engineering and Science Applications
7) Randomized Algorithms
8) Parallel Algorithms
9) Hardware Security

Note: The courses listed here are just few examples. The student can take courses offered in CSE/IT discipline which are 12 weeks minimum duration.

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III Year – II Semester		L	T	P	C
		3	0	0	3

MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTANCY

Course Objectives:
- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting.
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation.
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

Unit-I
Introduction to Managerial Economics and demand Analysis:
Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects – Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

Unit – II:
Theories of Production and Cost Analyses:
Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

Unit – III:
Introduction to Markets, Theories of the Firm & Pricing Policies:
Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.

Unit – IV:
Introduction to Accounting & Financing Analysis:
Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)

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Unit – V:
Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Course Outcomes:
- The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product.
- The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
- The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.
- The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis.
- The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

TEXT BOOKS:
A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

REFERENCES:
1. Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd,
2. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
3. N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd,
4. MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
5. I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
6. V. Maheswari, Managerial Economics, S. Chand & Company Ltd,

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		L	T	P	C
III Year – II Semester		0	0	3	1.5
	WEB TECHNOLOGIES LAB				

Course Objectives:

From the course the student will

- Learn the core concepts of both the frontend and backend programming course
- Get familiar with the latest web development technologies
- Learn all about PHP and SQL databases
- Learn complete web development process

Course Outcomes:

By the end of the course the student will be able to

- Analyze and apply the role of languages like HTML, CSS, XML
- Review JavaScript, PHP and protocols in the workings of the web and web applications
- Apply Web Application Terminologies, Internet Tools, E – Commerce and other web services
- Develop and Analyze dynamic Web Applications using PHP & MySql
- Install & Use Frameworks

List of Experiments:

1) Design the following static web pages required for an online book store web site:

(a) **HOME PAGE:**
The static home page must contain three **frames**.
Top frame: Logo and the college name and links to Home page, Login page, Registration page, Catalogue page and Cart page (the description of these pages will be given below).
Left frame: At least four links for navigation, which will display the catalogue of respective links.
For e.g.: When you click the link **"MCA"** the catalogue for MCA Books should be displayed in the Right frame.
Right frame: The *pages to the links in the left frame must be loaded here*. Initially this page contains description of the web site.

Logo	Web Site Name			
Home	Login	Registration	Catalogue	Cart
mca mba BCA	Description of the Web Site			

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(b) **LOGIN PAGE:**

Logo	Web Site Name			
Home	Login	Registration	Catalogue	Cart
MCA MBA BCA		Login : `11a51f0003` Password: `*******`		
		Submit Reset		

(c) **CATOLOGUE PAGE:**
The catalogue page should contain the details of all the books available in the web site in a table:
The details should contain the following:
1. Snap shot of Cover Page.
2. Author Name.
3. Publisher.
4. Price.
5. Add to cart button.

Logo	Web Site Name			
Home	Login	Registration	Catalogue	Cart
MCA MBA		Book : XML Bible Author : Winston Publication : Wiely	$ 40.5	Add to cart
BCA		Book : AI Author : S.Russel Publication : Princeton hall	$ 63	Add to cart
		Book : Java 2 Author : Watson Publication : BPB publications	$ 35.5	Add to cart
		Book : HTML in 24 hours Author : Sam Peter Publication : Sam	$ 50	Add to cart

(d). **REGISTRATION PAGE:**
Create a "*registration form* "with the following fields
1) Name (Text field)   2) Password (password field)
3) E-mail id (text field)   4) Phone number (text field)
5) Sex (radio button)   6) Date of birth (3 select boxes)
7) Languages known (check boxes – English, Telugu, Hindi, Tamil)

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8) Address (text area)

2) Design a web page using **CSS (C**ascading **S**tyle **S**heets**)** which includes the following: Use different font, styles:
In the style definition you define how each selector should work (font, color etc.).
Then, in the body of your pages, you refer to these selectors to activate the styles

3) Design a dynamic web page with validation using JavaScript.

4) Design a HTML having a text box and four buttons viz Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate javascript function should be called to display
   a. Factorial of that number
   b. Fibonacci series up to that number
   c. Prime numbers up to that number
   d. Is it palindrome or not

5) Write JavaScript programs on Event Handling
   a. Validation of registration form
   b. Open a Window from the current window
   c. Change color of background at each click of button or refresh of a
      page
   d. Display calendar for the month and year selected from combo box
   e. On Mouse over event

6) Write an XML file which will display the Book information which includes the following:
   1) Title of the book   2) Author Name   3) ISBN number
   4) Publisher name   5) Edition   6) Price
   a) Write a Document Type Definition (DTD) to validate the above XML file.
   b) Write a XML Schema Definition (XSD) to validate the above XML file.

7) Create Web pages using AJAX.

8) User Authentication:
   Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a PHP for doing the following.
   1. Create a Cookie and add these four user id's and passwords to this Cookie.
   2. Read the user id and passwords entered in the Login form (week1)   and authenticate with the values (user id and passwords) available in the cookies.
   If he is a valid user (i.e., user-name and password match) you should welcome him by name (user-name) else you should display "You are not an authenticated user ''.
   Use init-parameters to do this.

9) Example PHP program for registering users of a website and login.

10) Install a database (Mysql or Oracle).

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Create a table which should contain at least the following fields: name, password, email-id, phone number (these should hold the data from the registration form).

Write a PHP program to connect to that database and extract data from the tables and display them. Experiment with various SQL queries.

Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page (week2).

11) Write a PHP which does the following job:

Insert the details of the 3 or 4 users who register with the web site (week9) by using registration form. Authenticate the user when he submits the login form using the user name and password from the database (similar to week8 instead of cookies).

12) Implement a Servlet program on request response processing.

13) Implement a Servlet program for Registration Page.

14) Connect to a database using JSP and practice SQL Queries (MySql or Oracle).

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III Year – II Semester		L	T	P	C
		0	0	3	1.5
	DATA MINING LAB				

Course Objectives:
- To understand the mathematical basics quickly and covers each and every condition of data mining in order to prepare for real-world problems
- The various classes of algorithms will be covered to give a foundation to further apply knowledge to dive deeper into the different flavors of algorithms
- Students should aware of packages and libraries of R and also familiar with functions used in R for visualization
- To enable students to use R to conduct analytics on large real life datasets
- To familiarize students with how various statistics like mean median etc

Course Outcomes:
At the end of the course, student will be able to
- Extend the functionality of R by using add-on packages
- Examine data from files and other sources and perform various data manipulation tasks on them
- Code statistical functions in R
- Use R Graphics and Tables to visualize results of various statistical operations on data
- Apply the knowledge of R gained to data Analytics for real life applications

List of Experiments:
1. Implement all basic R commands.
2. Interact data through .csv files (Import from and export to .csv files).
3. Get and Clean data using swirl exercises. (Use 'swirl' package, library and install that topic from swirl).
4. Visualize all Statistical measures (Mean, Mode, Median, Range, Inter Quartile Range etc., using Histograms, Boxplots and Scatter Plots).
5. Create a data frame with the following structure.

EMP ID	EMP NAME	SALARY	START DATE
1	Satish	5000	01-11-2013
2	Vani	7500	05-06-2011
3	Ramesh	10000	21-09-1999
4	Praveen	9500	13-09-2005
5	Pallavi	4500	23-10-2000

   a) Extract two column names using column name.
   b) Extract the first two rows and then all columns.
   c) Extract 3rd and 5th row with 2nd and 4th column.
6. Write R Program using 'apply' group of functions to create and apply normalization function on each of the numeric variables/columns of iris dataset to transform them into
   i) 0 to 1 range with min-max normalization.
   ii) a value around 0 with z-score normalization.

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7. Create a data frame with 10 observations and 3 variables and add new rows and columns to it using 'rbind' and 'cbind' function.
8. Write R program to implement linear and multiple regression on 'mtcars' dataset to estimate the value of 'mpg' variable, with best R^2 and plot the original values in 'green' and predicted values in 'red'.
9. Implement k-means clustering using R.
10. Implement k-medoids clustering using R.
11. implement density based clustering on iris dataset.
12. implement decision trees using 'readingSkills' dataset.
13. Implement decision trees using 'iris' dataset using package party and 'rpart'.
14. Use a Corpus() function to create a data corpus then Build a term Matrix and Reveal word frequencies.

Text Books:
1) R and Data Mining: Examples and Case Studies, 1st ed, Yanchang Zhao, Sprnger, 2012.
2) R for Everyone, Advanced Analytics and Graphics, 2nd ed, Jared Lander, Pearson, 2018.

e-Resources:
1) www.r-tutor.com

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		L	T	P	C
III Year – II Semester		**0**	**0**	**0**	**1**
Industrial Training / Skill Development Programmes / Research Project in Higher Learning Institutes					

Note: The Industrial Training / Skill Development Programmes / Research Project in higher learning institutes should be taken during the semester gap between II B.Tech-II Semester and III B.Tech-I Semester for a period of 4 weeks.

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IV Year – I Semester		L	T	P	C
		3	0	0	3

CRYPTOGRAPHY AND NETWORK SECURITY

Course Objectives:

This course aims at training students to master the:

- The concepts of classical encryption techniques and concepts of finite fields and number theory
- Working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms
- Design issues and working principles of various authentication protocols, PKI standards
- Various secure communication standards including Kerberos, IPsec, and SSL/TLS and email
- Concepts of cryptographic utilities and authentication mechanisms to design secure applications

Course Outcomes:

By the end of the course the student

- Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory
- Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication
- Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes
- Apply different digital signature algorithms to achieve authentication and create secure applications
- Apply network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP
- Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications

UNIT I

Classical Encryption Techniques: Security Attacks, Services & Mechanisms, Symmetric Cipher Model. Cyber Threats, Phishing Attack, Web Based Attacks, SQL Injection Attacks, Buffer Overflow& Format String Vulnerabilities, TCP session hijacking, UDP Session Hijacking. Block Ciphers: Traditional Block Cipher Structure, Block Cipher Design Principles.

UNIT II

Symmetric Key Cryptography: Data Encryption Standard (DES), Advanced Encryption Standard (AES), Blowfish, IDEA, Block Cipher Modes of Operations. Number Theory: Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder Theorem, Discrete Logarithms.

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UNIT III

Public Key Cryptography: Principles, Public Key Cryptography Algorithms, RSA Algorithm, Diffie Hellman Key Exchange, Elliptic Curve Cryptography. Cryptographic Hash Functions: Application of Cryptographic Hash Functions, Requirements & Security, Secure Hash Algorithm, Message Authentication Functions, Requirements & Security, HMAC & CMAC. Digital Signatures: NIST Digital Signature Algorithm, Key Management and Distribution.

UNIT IV

User Authentication: Remote User Authentication Principles, Kerberos. Electronic Mail Security: Pretty Good Privacy (PGP) And S/MIME. IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

UNIT V

Transport Level Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security(TLS), Secure Shell(SSH).
Firewalls: Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration, Trusted Systems.

Text Books:
1) Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition.
2) Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition.

Reference Books:
1) Cryptography and Network Security- Behrouz A Forouzan, Debdeep Mukhopadhyay, McGrawHill, 3rd Edition, 2015.
2) Network Security Illustrated, Jason Albanese and Wes Sonnenreich, MGH Publishers, 2003.

e-Resources:
1) https://nptel.ac.in/courses/106/105/106105031/ lecture by Dr. Debdeep MukhopadhyayIIT Kharagpur [Video Lecture]
2) https://nptel.ac.in/courses/106/105/106105162/ lecture by Dr. Sourav Mukhopadhyay IIT Kharagpur [Video Lecture]
3) https://www.mitel.com/articles/web-communication-cryptography-and-network-security web articles by Mitel Power Connections