BSc Degree programme

Computer Systems and Design

Regulations & Syllabi
(under CBCS)

2018

PSG COLLEGE OF TECHNOLOGY
Coimbatore 641004

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Government Aided Autonomous College Affiliated to Anna University, Chennai
Accredited by NAAC with 'A' Grade
ISO 9001:2015 Certified

7. Concurrent programming
8. Event driven programming with GUI framework
9. Implementing an application using JDBC

Total P: 60

SEMESTER V

18X501 MOBILE COMPUTING

3 0 0 3

INTRODUCTION: Introduction to mobile and wireless devices - wireless networking, Advantages and disadvantages of wireless networking, Evolution of mobile communication generations- Challenges in mobile computing – Vertical and horizontal mobile applications - Wireless LAN and Wireless WAN. (6)

CELLULAR CONCEPT: Wireless transmission - Frequencies for radio transmission - Regulations - Signals , Antennas, Signal propagation ,Path loss of radio signals , Additional signal propagation effects - Multi-path propagation - Multiplexing - Space division multiplexing - Frequency division multiplexing -Time division multiplexing - Code division multiplexing - Spread spectrum - Direct sequence spread spectrum - Frequency hopping spread spectrum. (10)

CELLULAR NETWORK : GSM-Mobile services - System architecture -- Handover – GPRS – Mobile services – System architecture – LTE Network architecture and interfaces (10)

MOBILE APPLICATIONS ARCHITECTURE: Wireless Internet – Wireless Internet Architecture – Smart Client – Smart Client Architecture – Messaging Architecture – The Model-View-Controller Model- Delegate Pattern- Building Smart Client Applications **-** Design, Development, implementation, testing and deployment phase. (5)

MOBILE APPLICATION DEVELOPMENT: Introduction to Android Platform – Android architecture overview - Application life cycle - UI design for Android - Different types of layouts – Widgets – List view and Adapters - Dialogs and Toasts – Intent filters - Files and database – SQLite on Android - Security model – Comparison with IOS application development. (14)

Total L: 45

TEXT BOOKS:

1. Jochen Schiller, “Mobile Communications”, Pearson Education, 2012.
2. Martyn Mallick, “Mobile and Wireless Design Essentials”, Wiley, 2003
3. Bill Philips, Kristin Marsicano and Chris Stewart, “Android Programming : The big Nerd Ranch guide”, O’Reily, 2017.

REFERENCES:

1. Andreas F.Mohisch, “Wireless Communications”, Wiley, 2010.
2. David Taniar, “Mobile computing concepts, methodologies, tools and applications”, IGI Global, 2009.
3. Ronan Schwarz, Phil Dutson, James Steele and Nelson To, “The Android Developer's Cookbook Building Applications with the Android SDK”, Addison Wesley, 2013.

18X502 COMPUTER GRAPHICS AND MULTIMEDIA

3 0 0 3

INTRODUCTION AND OVERVIEW OF GRAPHICS SYSTEMS: Use of Computer graphics, Video Display Devices, Refresh Cathode-Ray Tubes, Raster and Random Scan Displays, Colour CRT Monitors, Direct View Storage Tubes, Flat Panel Displays, Three-Dimensional Viewing Devices, Stereoscopic & Virtual Reality Systems, Raster and Random Scan Systems, Different Input and Hard Copy Devices, Graphics Softwares. (6)

OUTPUT PRIMITIVES: Points and Lines, Line Drawing Algorithms (DDA & Bresenham’s), Circle and Ellipse Generating Algorithms. (5)

TWO-DIMENSIONAL GEOMETRIC TRANSFORMATIONS: Different types of transformations and their matrix representations, Homogeneous Coordinates, Composite Transformations, transformations between Coordinate Systems, Affine transformations, Window-to-Viewport Coordinate transformation, Clipping-Point, Line, Polygon, Curve and Text Clipping. (8)

THREE-DIMENSIONAL CONCEPTS AND OBJECT REPRESENTATION: Three Dimensional Display Methods, Polygon Surfaces, Curved Lines & Surfaces, Quadric Surfaces, Spline Representations, Cubic Spline interpolation methods, Bezier Curves and Surfaces. (6)

THREE DIMENSIONAL TRANSFORMATIONS AND VIEWING: Translation, Rotation, Scaling, Reflection, Shears, Composite Transformations, Projections- Parallel and Perspective, Projection Transformations, Clipping. (6)

VISIBLE SURFACE DETECTION METHODS: Classification of Visible Surface Detection Algorithms, Back Face Detection, Depth Buffer Method, A-Buffer Method, Scan-Line Method, Depth Sorting Method, BSP-Tree Method & Area Subdivision Method. Polygon-Rendering Methods. (6)

INTRODUCTION TO MULTIMEDIA SYSTEMS DESIGN: An Introduction – Multimedia applications – Multimedia System Architecture – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases. (4)

COMPRESSION & DECOMPRESSION: Data & File Format standards – Multimedia I/O technologies - Digital voice and audio – video image and animation – Full motion video – Multimedia Authoring & User Interface – Hypermedia messaging. (4)

Total L: 45

TEXT BOOKS:

1. Hearn D. & M.P. Baker, "Computer Graphics with open GL", Pearson Education, 2014.
2. Prabat K. Andleigh and Kiran Thakrar, "Multimedia Systems and Design", Prentice Hall, 2009.

REFERENCES:

1. Newman W.M., "Principle of Interactive Computer Graphics", Tata McGraw Hill, 2011.
2. Foley James D, Vandam Andries and Hughes John F, "Computer Graphics: Principles and Practice", Addison Wesley, 2013.
3. Angel, "Interactive Computer Graphics: A top down approach with open GL", Addison Wesley, 2011.
4. David F Rogers, "Procedural Elements for Computer Graphics", Tata McGraw Hill, 2011.

18X503 MACHINE LEARNING

3 0 0 3

INTRODUCTION: Supervised learning – Supervised learning setup - Regression – Linear Regression – Polynomial Regression – Multiple Regression. (6)

CLASSIFICATION - Logistic regression- Exponential family- Generative learning algorithms- Gaussian discriminant analysis- Naive Bayes –- Neural Networks – Simple Perceptron – Multi-Layer Perceptron -Support vector machines - Linearly separable data, overlapping classes, non-linearly separable - K-Nearest Neighbours. (18)

DECISION TREES – Univariate trees – Rule extraction from trees – Pruning trees - Multivariate trees - Linear Discriminant Analysis - Model selection and feature selection - Evaluating and debugging learning algorithms- Maximum likelihood estimation – parametric classification. (12)

LEARNING THEORY - Bias/variance tradeoff –VC dimension – PAC Learning (2)

UNSUPERVISED LEARNING– Clustering –Types - K-means – EM - Mixture of Gaussians - Hierarchical clustering – AGNES – Cluster validity measures – dimensionality reduction- Subset selection –extraction - PCA (Principal components analysis) (7)

Total L: 45

TEXT BOOKS:

1. Christopher M Bishop, "Pattern Recognition and Machine Learning", Springer, 2013.
2. Richard O Duda, Peter E Hart and David G Stork, "Pattern Classification (Digitized)", John Wiley, 2012.

REFERENCES:

1. David Barber, "Machine Learning: A Probabilistic Approach", http://www.idiap.ch/~barber, 2006.
2. Alpaydin Ethem, "Introduction to Machine Learning", MIT press, 2009.
3. Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The Elements of Statistical Learning", Springer, 2013.

18X504 MOBILE COMPUTING LABORATORY

0 0 4 2

1. Android SDK installation and study
2. Defining Layouts
3. Single Activity Application, Application with multiple activities
4. Application using GUI Widgets
5. Application with Notifications
6. Using Intents to Launch Activities
7. Creating and Saving Shared Preferences
8. Retrieving Shared Preferences
9. Usage of SQLite Databases for storage
10. Location based service creation **Total P: 60**

18X505 COMPUTER GRAPHICS AND MULTIMEDIA LABORATORY

0 0 4 2

1. OpenGL IDE and MINGW setup, . Implementation of A sample program in OpenGL
2. Designing primitive objects in OpenGL
3. Applications for keyboard and mouse interactions
4. Line drawing algorithms – basic line equation method, DDA Algorithm
5. Bresenham Line drawing algorithms and simple primitives using Bresenham algorithm.
6. Circle and Ellipse Drawing algorithm.
7. Basic 2D transformations and applications

8. Window – Viewport simulation, Line Clipping Algorithm Implementation
9. Polygon Clipping Algorithm Implementation
10. Drawing 2D curves using Bezier
11. Drawing 2D curve using B-Spline
12. Applications for 3D Transformation
13. Implementation of 3D Projections
14. Implementation of Back face detection (Visible Surface Detection)
15. Construction of Multimedia database
16. Data Compression and decompression on multimedia data.

Total P: 60

18X506 MACHINE LEARNING LABORATORY

0 0 4 2

Download the datasets from UCI machine learning repository / www.kaggle.com for classification and clustering

1. Implement linear, polynomial and multiple regression.
2. Implement the following Classification algorithms for the above datasets.
    a. Naïve Bayes Algorithm
    b. Decision tree
    c. SVM
    d. K nearest neighbor
3. Do tenfold cross validation experiments and statistical validation using t-test and ANOVA.
4. Implement different clustering techniques.
5. Evaluate Performance measures for classification / clustering.

Total P: 60

SEMESTER VI

18X601 DISTRIBUTED ENTERPRISE COMPUTING

3 2 0 4

DISTRIBUTED SYSTEM COMPUTING : Types of UI – CSS – Validation - Operating System Services for Client – Server Types – Server Side Scripting – Operating System Services for Server – Client and Server Software Requirements. (8)

DISTRIBUTED MULTI-TIER COMPUTING: Basis of Distributed Computing – Decomposition Approaches – Layers and Tiers – Component Based Software Development for Enterprise – Enterprise Architectural Overview – Java Enterprise System. (7)

COMMUNICATION: Message Passing - Features and Issues – Synchronization – Buffering – Process addressing – Failure handling – Remote Procedure Call: Model – Implementation – Stub generation – RPC messages – Marshaling –Server management – Call semantics – IDL – UUID. (8)

MIDDLEWARE: Architecture – Classification of Middleware – Architecture of Middleware – Communication Middleware – ODBC – JDBC – Connection – Statement - Transaction Middleware – Isolation – Interfacing – Overview of RMI - DCOM - CORBA . (8)

ENTERPRISE WEB COMMUNICATION – Java Servlets – Packages - Generic Servlets - HTTP Servlet – Session Management - JSP – Elements of JSP – Directives - Java Beans in JSP – JSTL - Libraries. (8)

FRAMEWORKS: Introduction to Frameworks – Spring – Hibernate (6)

TUTORIAL PRACTICE:

1. Implementation of two, three and multi-tier applications
2. Developing distributed environment applications
3. RMI communication between two application
4. Servlet programs
5. JSP programs
6. Database connectivity programs
7. Component development using JavaBeans
8. Application using any one of the frameworks

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Robert Orfali, Dan Harkey and Jeri Edwards, “Client / Server survival Guide”, Wiley, 2011.

REFERENCES:

1. Liu M L, “Distributed Computing: Principles and Applications”, Pearson Education, 2013.
2. George Reese, “Database programming, with JDBC and Java", O'Reilly, 2013.
3. Dustin R. Callaway, "Inside Servlets", Pearson Education, 2009.
4. Bill McCarty and Luke Cassady Dorion - "Java Distributed Objects (Digitized)", Tech Media, 2011.
5. Phil Hanna, “JSP 2.0: The Complete Reference”, Tata McGraw Hill, 2011.

18X602 SOFTWARE TESTING

3 2 0 4

INTRODUCTION: Need for testing – Psychology of testing – Testing economies – Types of testing – SDLC and testing – Verification and Validation. (5)

TESTING STRATEGIES: White box testing techniques – Statement coverage – Branch coverage – Condition Coverage – Decision/condition coverage – Multiple condition coverage- Data flow coverage – Mutation testing – Automated code coverage analysis – Black box testing techniques – Boundary value analysis – Robustness analysis – Equivalence partitioning – Syntax testing – Finite state testing – Levels of testing – Unit, Integration and System testing. (15)

TESTING A SOFTWARE USING A LIFE CYCLE METHODOLOGY: Requirements phase testing - Design phase testing - Program phase testing - Acceptance testing - Installation testing - Evaluating test effectiveness – Maintenance phase testing. (9)

TEST PLAN: Positive and Negative Test cases, Preparation of test plan – Test script. (3)

TESTING OBJECT ORIENTED SOFTWARE: Challenges – Differences from testing non-OO software – Class testing strategies (6)

TECHNIQUES FOR AUTOMATING TEST EXECUTION: Testing and test automation – the V model – Tool support for lifecycle testing – promise of test automation, common problems of test automation – limitations of automating software testing (7)

TUTORIALS PRACTICE:

1. Exercise for code review process.
2. Implementing Testing Techniques : White box testing, Basis Path, Looping, Black box methods.
3. Test the package for functional regression testing.
4. Preparation of test plan, test cases for developed package.
5. Design test cases using Rational test manager.
6. Use Rational robot for functional testing for developed package.
7. Use Configuration management tool for recording test artifacts.
8. Testing the package for load test using load runner.
9. Test the package for coverage analysis using tools.
10. Test the package for reliability testing using tools.
11. Test the package for memory management using Open source tools.

Total L: 45 + T: 30 = 75

TEXT BOOK:

1. William Perry, "Effective Methods for Software Testing", Wiley, 2009.

REFERENCES:

1. John Watkins, “Testing IT: An off the shelf software testing process”, Cambridge Press, 2010.
2. Boriz Beizer, “Software Testing Techniques”, Dream Tech , 2010.

18X603 PROJECT WORK

0 0 12 6

PROFESSIONAL ELECTIVES

18XA01 WEB SERVICES

3 2 0 4

XML: Introduction to XML – Comparison with HTML – XML Documents – Well–Formed XML Document – Markup and Character Data – Prolog and XML Declaration – Processing Instructions – XML Elements – Types of Elements – Attributes – Elements Vs Attributes – C DATA Sections – XML Namespaces – DTD. (7)

XML SCHEMAS: Validating XML documents using XML Schema – Comparison with DTD – Creation of Simple Types – Specifying attribute constraints and defaults – Creation of Complex type – Specifying different types of content using Complex Type – Specifying data types and restrictions in Schema. – XML Applications and Development. (7)

DOM AND SAX: Comparison – Creating a DOM parser – Displaying and Filtering XML documents –working with SAX – Displaying and Filtering XML documents. (4)

XML TECHNOLOGIES: XLINK , XPOINTERS, XQUERY, SVG, RDF. (4)

WEB SERVICES: Introduction – Basics – Interacting with Web Services – Technology of Web Services. (5)

SOAP: SOAP Message Exchange Model – Relation to XML – SOAP Envelope – Head – Body – Fault – SOAP Encoding – Using SOAP and HTTP – Using SOAP for RPC – Security Considerations. (6)

WSDL: WSDL Document structure – Types, Messages, Port types, Bindings, Ports, Services – SOAP binding – HTTP GET and POST Binding. (6)

UDDI: Introduction – UDDI Data Structure – Business Entity – Business Service – Binding Template – tModel – Technical Overview – UDDI API – Inquiry API, Publication API – Security. (6)

TUTORIAL PRACTICE:

1. Validating XML using DTD
2. Validating XML using XML Schema
3. Formatting XML documents using CSS/XSLT
4. Implementation of Web Services Architecture
5. Creating Web Services communication in Windows Platform
6. Implementation of Web Services using Java Technology
7. Implementation of Web Services using .NET Technology

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Ron Schmalzer, Travis Vandersypen, Jason Bloomberg, "XML and Web Services Unleashed", Pearson Education, 2008.
2. Martin KAlin, "Java Web Services: Up and Running", O'Reilly, 2013.

REFERENCES:

1. Robert Deigneau, "Service Design Patterns: Fundamental design solutions for SOAP/WSDL and RESTful web services", Addison Wesley, 2011
2. Greg Lomow, Eric Newcomer, "Understanding SOA with Web Services", Pearson Education, 2005.

18XA02 OPEN SOURCE SOFTWARE

3 2 0 4

INTRODUCTION: Proprietary Software, Free Software, Open Software, Licenses, Version Control, Explore GitHub – GitHub Workflows, Git Basics, Git Branching, Git on the Server, Distributed Git, GitHub, Git Tools, Customizing Git. (6)

PHP PROGRAMMING LANGUAGE: Basics – Data types – operators and flow control – String – Arrays – Functions – PHP with HTML – Client side validation – Working with Databases (9)

PYTHON PROGRAMMING LANGUAGE: Basic Syntax, Functions, Conditionals and Recursion, Iteration, Strings, Lists, Dictionaries, Tuples, Files, Classes and Objects, Inheritance, CGI, Multithreading, Networking, Python GUI - Tkinter, Distributing Python Modules, Python Standard Library, Django Framework. (9)

RUBY PROGRAMMING LANGUAGE: Foundations and Scaffolding – Ruby Building Blocks, Ruby Ecosystem, The Core of Ruby - Classes, Objects, and Modules, Projects and Libraries, Error Handling, Files and Databases, Deploying Ruby Applications, Ruby Online (8)

RUBY ON RAILS: Scaling Rails, rails server, Deploying – Heroku Setup, User Resource, Microposts Resource, Static and Slightly Dynamic Pages, Rails Flavoured Ruby, Filling in the Layout, Modeling Users, Sign Up, Sign In, Sign Out, Updating, Showing, Deleting Users, User Microposts, Following Users. (8)

WEB SERVER: Application Server Vs Web server– Characteristics of Web server – Case Study: Apache Tomcat Web Server (5)

TUTORIAL PRACTICE:

1. Explore and contribute to GitHub
2. Working with PHP and MySQL
3. Exercises using NumPy/SciPy
4. Exercises in Ruby.
5. Application Development and Deployment using Rails Framework.
6. Installation of Apache Tomcat Web Server.

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Steven Holzner, "PHP: The Complete Reference", Tata McGraw Hill, 2010.
2. Allen B Downey, "Think Python", O'Reilly, 2012.
3. Michael Hartl, "Ruby on Rails Tutorial", Addison Wesley, 2012.

REFERENCES:

1. Scott Chacon, "ProGit", Apress, 2009.
2. Paul Berry, "Head First Python", O'Reilly, 2010.
3. Ivan Bayoss, Shranam shah, " PHP 5.1 for beginners", Shroff Publishers & Distributors Pvt Ltd, 2010
4. Peter Cooper, "Beginning Ruby-From Novice to Professional", Apress, 2009.

18XA03 SERVICE ORIENTED ARCHITECTURE

3 2 0 4

INTRODUCTION: Business Computing – Globalization and development of enterprise computing. Inventory of Distributed computing - Service Orientation – Loose Coupling – Granularity - Scope variance. Software Architectures – Service oriented architecture – benefits – Obstacles and roadmap for SOA - Comparison service orientation and Object and Component orientation. (6)

SOA ENABLING TECHNOLOGY: Introduction to XML Technologies– XML – DTD – XSD. Web Services Basis - Web Services versus SOA. Service Discoverability - Universal Description Discovery and Integration – Programming UDDI – UDDI Data Model – UDDI SOAP APIs – Inquiry APIs – Publisher APIs. Service Description and Look up - Web Service Definition Language – Defining Message data types – Defining Operations on Messages –WSDL documents usage Scenarios. Service Interactions– Simple Object Access Protocol – SOAP Specification – SOAP Message processing – SOAP use of Namespaces – SOAP Multipart MIME attachments - SOAP binding - State management and Security in WebServices - Web Service standards and extensions. (12)

BUSINESS PROCESS MANAGEMENT: Basic Business process management Concepts – examples – Business modeling – options - Basis of workflow - atomic services and composite services Service orchestration and Choreography – Business Process Execution Language. –Business process reengineering and management- Combining BPM – SOA – Web Services –Long lived Transactions. (8)

SOA ENABLED APPLICATION: SOA modeling – concepts and tools. SOA Assembly and Deploy – Integration developer, Enterprise Service Bus and Process Runtime. SOA Manage - SOA Governance (7)

SOA ENABLED ENTERPRISE: Enterprise Application Integration using SOA – Integrating applications and Data using Web Services and XML -Integration of legacy. (8)

CASE STUDIES: Inter-Enterprise applications like Insurance Claim processing - Credit Card based online transaction – Direct to Home Services. (4)

TUTORIAL PRACTICE:

1. Creation and validation of XML documents
2. Design Web Services
3. Invoking Web Services from other applications
4. Service assembly and deployment
5. Application integration

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Thomas Erl, “SOA Principles of Service Design”, Pearson Education, 2009.
2. Eric Newcomer and Greg Lomow, “Understanding SOA with Web Services”, Pearson Education, 2009.
3. Dirk Krafzig, Karl Banke and Dirk Slama, “Enterprise SOA, Service oriented architectures best practices”, Prentice Hall, 2008.

REFERENCES:

1. Sandeep Chatterjee and James Webber, “Developing Enterprise Web Services”, Pearson Education, 2007.
2. Thomas Erl, “Service Oriented Architecture: A Field Guide to Integrating XML and Web Services”, Prentice Hall, 2007.
3. James McGovern, Oliver Sims, Ashish Jain and Mark Little “Enterprise Service Oriented Architectures: Concepts, Challenges Recommendations”. Springer, 2006.
4. Thomas Erl, “Service Oriented Architecture (SOA): Concepts, Technology and Design”, Prentice Hall, 2005.

18XA04 ARTIFICIAL INTELLIGENCE

3 2 0 4

INTRODUCTION: The foundations of AI - The History of AI - Intelligent agents - Agent based system. (2)

PROBLEM SOLVING: State Space models - Searching for solution - Uninformed/Blind search - Informed/ Heuristic search - A* search - Hill-climbing search - Meta Heuristic: Genetic Algorithm - Adversary based search : Minimax - Expectimax – Alpha Beta pruning – Constraint satisfaction problem - Backtracking search (10)

KNOWLEDGE REPRESENTATION AND REASONING: Knowledge representation - Logic - inference - Fuzzy logic: membership - Fuzzy rules and reasoning - Fuzzy inference (8)

UNCERTAIN KNOWLEDGE AND PROBABILISTIC REASONING: Uncertainty - Probabilistic reasoning - Semantics of Bayesian network - Exact inference in Bayesian network- Approximate inference in Bayesian network - Dynamic Bayesian Networks (10)

DECISION-MAKING: Basics of utility theory, Utility functions - Sequential decision problems - Markov decision process - Value iteration - Policy iteration - Decisions in Multi agent system: Multi agent decision theory - Group decision making. (10)

LEARNING: Learning from observation – Supervised Learning - Unsupervised - Reinforcement learning. Robotics - Introduction.

(5)

Total L: 45

TUTORIAL PRACTICE:

1. Search Techniques: A* algorithm for 8 – puzzle and Missionaries and Cannibals problem, Hill climbing, genetic algorithm and Constraint satisfaction techniques
2. Simple games – minimax and expectimax
3. Logic based exercises, Fuzzy Inference System.
4. Decision making: Implementing HMM models, sequential and multi agent decision making

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Pearson Education, 2014.
2. David Pool and Alan Mackworth, “Artificial Intelligence: Foundations of Computational agents”, Cambridge University Press, 2017.
3. Daphne Koller and N Friedman, “Probabilistic Graphical Models - Principles and Techniques”, MIT press, 2009.
4. Tsang and Edward, “Foundations of Constraint Satisfaction: The Classic Text”, BoD–Books on Demand, 2014.

REFERENCES:

1. Christopher M.Bishop, “Pattern Recognition and Machine Learning”, Springer, 2013.
2. Nils J. Nilsson, “The Quest for Artificial Intelligence: A History of Ideas and achievements”, Cambridge University Press, 2010.

18XA05 DATA MINING

3 2 0 4

INTRODUCTION: Motivation for Data Miniing – Importance – Definition – Kinds of data for Data Mining – Data Mining functionalities – Patterns – Classification of Data Mining Systems – Major issues in Data Mining. (5)

DATA PREPROCESSING: Types of data - Data cleaning – Data Aggregation – Data Discretization - Sampling – Data Reduction – Feature subset selection - x^2 and Information Gain. (6)

MINING FREQUENT PATTERNS, ASSOCIATION AND CORRELATIONS: Basic concepts – Efficient and scalable frequent item set mining methods – Apriori, FP tree, ECLAT. (8)

ENSEMBLE OF CLASSIFIERS: Classification – Ensemble Learning – Bagging, Boosting, Cascading – Ensemble Pruning. (9)

C**LUSTER ANALYSIS:** A categorization of major clustering methods – partitioning methods – hierarchical methods – density based methods – DBSCAN, OPTICS, DENCLUE - Outlier analysis. (9)

MINING DATA STREAMS: : Challenges-Mining time- Series databases and sequence data –Stationary data stream learning- Hoeffding trees- Evolving data stream mining. (4)

APPLICATIONS AND TRENDS IN DATA MINING: Spatial Data Mining –Graph Mining- Web Mining –Text Mining. (4)

TUTORIAL PRACTICE:

1. Problems on Data mining tools like WEKA
2. Association rule mining using Apriori and FP-tree algorithms
3. Evaluating the performance of classifiers
4. Clustering techniques.
5. A Package using data mining techniques preferably research papers

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Jiwei Han and Micheline Kamber , “Data Mining – Concepts and Techniques”, Morgan Kaufmann, 2011.
2. Tan, Steinbach, Kumar, “Introduction to Data Mining”, Pearson Education, 2007.

REFERENCES:

1. Anand Rajaraman, and Jeffrey Ullman, “Mining Massive Data sets”, Cambridge University Press, 2012.
2. Trevor Hastie, Robert Tibshirani, Jerome Freidman,” The Elements of Statistical Learning: Data Mining, Inference and Prediction”, Springer, 2011.
3. Ian Witten, Frank Eibe, Mark A Hall and Geffery Holmes, "Data Mining: Practical Machine Learning Tools”, Elsevier, 2011.

18XA06 NATURAL LANGUAGE PROCESSING

3 2 0 4

INTRODUCTION: Natural language processing techniques**-** The different analysis levels used for NLP: morpho-lexical - syntactic – semantic - pragmatic - markup (TEI, UNICODE) – Applications – open problems. (3)

WORDS: Regular expressions – Automata – Morphology – Finite state Transducers – Finite state morphological parsing – Combining FST lexicon and rules – Porter Stemmer Algorithm – Probabilistic models for Spelling – Bayes method, Minimum edit distance - N-Grams – Counting words in Corpora – Simple n-grams – Smoothing – Evaluating language models : Entropy, Perplexity- Part of Speech Tagging (POS) – Rule based tagging – Stochastic based tagging – Transformation based tagging - Context Free Grammars - Top down parser – Earley Algorithm – Bottom-up parsing – CYK parser – Probabilistic parsing. (15)

SEMANTICS: Meaning structure of a language – First order predicate calculus – Alternative approaches to meaning – Syntax driven sematic analysis – Attachments for a fragment of English – Word Sense Disambiguation – Machine learning approaches – Dictionary based approaches – Pragmatics : Discourse – Text coherence (10)

NATURAL LANGUAGE GENERATION: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Language similarities and differences – The transfer metaphor – Direct translation – Statistical translation - Translation involving Indian Languages. (12)

CASE STUDIES: Sentiment Analysis **-** Information extraction - Automatic summarization - Information retrieval and Question answering - Named entity recognition and relation extraction - IE using sequence labeling (5)

TUTORIAL PRACTICE:

1. Implementing word similarity.
2. Implementing simple problems related to word disambiguation.
3. Simple demonstration of part of speech tagging.
4. Lexical analyzer.
5. Semantic analyzer.
6. Translation from one language into another language
7. Word sense disambiguation

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, Prentice Hall, 2009.
2. Christopher Manning and HinrichSchütze, “Foundations of Statistical Natural Language Processing”, MIT Press, 2003.

REFERENCES:

1. James Allen, “Natural Language Understanding”, Addison Wesley, 2008.
2. Steven Bird, Ewan Klein, and Edward Loper, “Natural Language Processing with Python - Analyzing Text with the Natural Language Toolkit”, O'Reilly Media, 2009.

18XA07 SEMANTIC WEB

3 2 0 4

INTRODUCTION TO SEMANTIC WEB: Today’s Web - From Today’s Web to the Semantic Web - Examples - Semantic Web Technologies - A Layered Approach. (4)

DESCRIBING STRUCTURED WEB DOCUMENTS USING XML: Introduction to Markup languages - The XML Language - Structuring - Namespaces - Addressing and Querying XML Documents - Processing. (8)

DESCRIBING WEB RESOURCES IN RDF: Introduction to RDF - Basic Ideas - RDF: XML-Based Syntax - RDF Schema: Basic Ideas - RDF Schema - An Axiomatic Semantics for RDF and RDF Schema - A Direct Inference System for RDF and RDFS - Querying in RQL. (9)

WEB ONTOLOGY LANGUAGE: OWL Introduction - The OWL Language - Examples - OWL in OWL - Future Extensions. (8)

LOGIC AND INFERENCE: Introduction - Example of Monotonic Rules: Family Relationships - Monotonic Rules: Syntax - Monotonic Rules: Semantics - Nonmonotonic Rules: Motivation and Syntax - Example of Nonmonotonic Rules - Rule Markup in XML for Monotonic Rules - Rule Markup in XML for Nonmonotonic Rules. (8)

APPLICATIONS: Horizontal Information Products - Data Integration - e-Learning - Web Services - Other Scenarios. (4)

ONTOLOGY ENGINEERING: Constructing Ontologies Manually - Reusing Existing Ontologies - Using Semiautomatic Methods - On-To-Knowledge Semantic Web Architecture. (4)

TUTORIAL PRACTICE:

1. Generate of well formed XML document.
2. Creating XML DTD and XSD for the given XML document.
3. Design a XSLT to display the XML document (given as input) based on the constraints given.
4. Generate an RDF graph.
5. Create an RDFS ontology (in triple or graph notation).
6. Write an RDF/XML encoding for the given situation.
7. Generation of OWL document.
8. A Package to implement the techniques.

Total L: 45 + T: 30 = 75

TEXT BOOK:

1. Grigoris Antoniou and Frank van Harmelen, "A Semantic Web Primer", MIT Press, 2012.

REFERENCES:

1. Dean Allemans, James Handler, "Semantic web for the working ontologist: Effective modeling in RDFS and OWL", Elsevier, 2011.
2. Breitman K. K., Casanova M A and Truszkowski W, "Semantic Web: Concepts, Technologies and Applications", Springer, 2007.

18XA08 CLOUD COMPUTING

3 2 0 4

INTRODUCTION TO PARALLEL AND DISTRIBUTED COMPUTING: Introduction, Architecture and Distributed computing models and technologies SOA, Web Services (5)

GRID, CLUSTER AND UTILITY COMPUTING: Introduction, Architecture, Pros & Cons, Real time applications. (5)

INTRODUCTION TO CLOUD COMPUTING: Definition, History, Comparison of Cloud Computing with Grid, Cluster and Utility Computing, Deployment models – Private, Public, Hybrid and Community - Pros and Cons of Cloud Computing . SaaS, PaaS, IaaS etc. (6)

VIRUTUALIZATION : Types of Virtualization, Tools for Virtualization, Architecture of VMM, Virtualization for Cloud. (5)

ADVANCED WEB TECHNOLOGIES: AJAX and Mashup – Programing examples using applications. (4)

MAP REDUCE PARADIGMS: Introduction, GFS Architecture, HDFS Architecture, Hbase, Google big Table, Amazon's (key value) pair storage and Microsoft's Azure infrastructure, Map reduce programming examples. (6)

CLOUD COMPUTING FRAMEWORK: Amazon EC3, S3 storage revises, Aneka frame work, IBM blue Cloud. (7)

APPLICATIONS: Distributed search engine and distributed data mining in the cloud. (7)

TUTORIAL PRACTICE:

1. Implement a distributed search engine.
2. Implement distributive data mining for an application.
3. Package to be developed using Virtualization and other cloud concepts.

Total L: 45 + T: 30 = 75

TEXT BOOK:

1. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw Hill, 2010.

REFERENCES:

1. Liu M. L., "Distributed Computing Principles and Applications", Pearson Education, 2005.
2. Ron Schmelzer et al, "XML and Web Services", Pearson Education, 2002.
3. Dean J. and Ghemawat S., "MapReduce: Simplified Data Processing on Large Clusters" , OSDI, 2004.
4. DeCandia et al G., "Dynamo Amazon's Highly Available Key-Value Store", SOSP, 2007.
5. Ghemawat S., Gobioff H and Leung S. T., "The Google File System", SOSP, 2003.

18XA09 DEEP LEARNING

3 2 0 4

Introduction – Neural networks - Deep Networks - Deep Feed forward Networks – Learning XOR, Gradient Based Learning – Hidden units , Design – Backpropagation - Regularization of deep learning. (5)

Optimization for training deep models – Challenges in neural network optimization - Basic algorithms – Parameter initialization strategies – Algorithms with adaptive learning rates – Meta algorithms. (10)

Convolutional networks – Convolution operation - Motivation – Pooling – Variants of convolution function. (8)

Recurrent networks – Unfolding computational graphs – Recurrent neural networks (RNN) – Bidirectional RNNs - Deep recurrent network – Methodology – Applications. (10)

Deep Learning Research : Linear Factor Models, Autoencoders, Representational Learning, Structured probabilistic models for deep learning, Monte Carlo Methods, Deep generative models. (8)

Applications: Natural language processing, Big Data, Brain Computer Interface, Visual Data, IoT. (4)

TUTORIAL PRACTICE:
1. Collect data sets from the url : http://deeplearning.net/datasets/
2. Use TensorFlow library for visualization of data sets in different domains and analysis:
   a. Music
   b. Image processing
   c. Text analysis (Next word prediction,etc)
   d. Speech processing

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville , Deep Learning, MIT Press, 2016.
2. Yoshua Bengio, Learning Deep Architectures for AI, Foundations & Trends in Machine Learning, 2009.

REFERENCES:

1. Adam Gibson, Josh Patterson "Deep Learning: A Practitioner's Approach ", OReilly, 2016.
2. Nicholas Locascio and Nikhil Buduma "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", OReilly, 2017.

18XA10 BIG DATA ANALYTICS

3 2 0 4

INTRODUCTION: Big Data Sources – Acquisition - Features of big data - Security, Compliance, Auditing and Protection - Evolution of Big Data - characteristics. (3)

MASSIVE DATASETS MINING: MapReduce – Algorithms using MapReduce – Finding Similar Items: Applications of Near-Neighbor Search – Shingling of Documents – Locality Sensitive Hashing for Documents. (10)

MINING DATA STREAMS: Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream. (5)

LINK ANALYSIS: PageRank – Efficient Computation of PageRank – Topic Sensitive PageRank – Link Spam – Hubs and Authorities – Advertising on the Web: Issues – The Adwords Problem - Social Network analysis (8)

DATA MODELING FOR BIG DATA: Big Data and Challenges, NoSQL data models, Basic principles of NoSQL models, SQL databases VsNoSQL databases. (4)

NOSQL DATABASES : Key - Value Stores: Oracle Coherence – Amazon DynamoDB, Key -Value Stores (in-memory) :Redis Key-value Stores (B-tree): Berkeley DB, Column Oriented Store: Google BigTable , Apache Cassandra - Hbase. Document Oriented Stores – MongoDB - Apache CouchDB - XML databases, Graph databases: Neo4J - OrientDB, Object Database: Db4o (13)

Data Visualization (2)

TUTORIAL PRACTICE:
1. Map Reduce Algorithm.
2. Shingling of Documents.
3. Bloom Filter.
4. Computation of Page Rank.
5. NoSql Databases
6. Adwords Implementation.

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Paul Zikopoulos, Dirk Deroos, Krishnan Parasuraman, Thomas Deutsch, David Corrigan, James Giles, “Harness the power of Big Data”,Tata McGraw Hill, 2013.
2. Peter Zadrozny, Raghu Kodali, “Big Data Analytics using Splunk”, Apress, 2013.
3. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.

REFERENCES:

1. Frank J. Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series, 2012.
2. Mike Barlow, “Real Time Big Data Analytics: Emerging Architecture”, O’ Reilly, 2013.
3. Elmasri R. and Navathe S.B., “Fundamentals of Database Systems”, Pearson Education, 2017.

18XA11 GRAPH THEORY

3 2 0 4

BASIC CONCEPTS: Graphs - directed and undirected, subgraphs, graph models, degree of a vertex, degree sequence, Havel-Hakimi theorem, Hand-shaking lemma. Connectivity, walk, path, distance, diameter. Isomorphic graphs. Common classes of graphs – regular, complete, Petersen, cycle, path, tree, k-partite, planar, hypercube, mesh. Spanning trees – Matrix tree theorem. (8)

CONNECTIVITY: Vertex and edge connectivity, Vertex and edge cuts, relationship between vertex and edge connectivity, bounds for connectivity. Harary's construction of k-connected graphs. (9)

EULERIAN AND HAMILTONIAN GRAPHS: Eulerian graphs, Route inspection problem, Hamiltonian graphs, Dirac's and Ore's theorems, Gray codes, traveling salesman problem. (9)

MATCHING: Maximum matching – augmenting paths, Berge's theorem, Bipartite matching - Hall's theorem, Perfect matching – Tutte's theorem, Edmonds' algorithm. (7)

COLORING: Vertex-coloring – upper chromatic number, bounds, sequential and largest degree first algorithms. Edge coloring – edge chromatic number, Vizing's theorem. (8)

DOMINATION: Dominating set, domination number, bounds, Types – distance-k domination, total domination, independence domination, connected. Applications to networks. (4)

TUTORIAL PRACTICE:

1. Constructing spanning tree
2. Implementation of Hararys construction of k-connected graphs
3. Fluery's algorithm
4. Travelling Salesman Problem
5. Augmenting path algorithm for matching
6. Sequential and largest degree first algorithm for vertex coloring
7. Finding a minimal dominating set

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Jonathan Gross and Jay Yellen, "Graph Theory and its Applications", CRC Press, 2006.
2. Haynes T. W., Hedetniemi and Slater P.J., "Fundamentals of Domination in Graphs", Marcel Dekker, 1998.

REFERENCES:

1. Bela Bollobas, "Random Graphs", Cambridge University Press, 2001.
2. Douglas B. West, "Graph Theory", Prentice Hall, 2001.

18XA12 SOFTWARE PATTERNS

3 2 0 4

INTRODUCTION: Reusable Software, Reusable object oriented software, Patterns, Definition, Overview & motivation, Categories, Relationship between patterns, Pattern description. (5)

DESIGN PATTERNS: Creational patterns - Abstract factory, Builder, Factory method, Prototype, Singleton. Structural patterns – Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy. Behavioral patterns – Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template method, Visitor, Case Studies. (15)

ARCHITECTURE PATTERNS: From Mud to Structure – Layers, Pipes and Filters, Blackboard. Distributed systems – Broker. Interactive Systems - Model View Controller (MVC), Presentation Abstraction Control, Adaptable Systems, Reflection, Microkernel. (5)

REFACTORING AND CODE SMELLS: Refactoring, Principles in Refactoring, Bad smells in Code, A Catalog of Refactoring with examples. (10)

IDIOMS – Antipatterns in Software development, software architecture, Pattern mining, Pattern Language. (10)

TUTORIALS PRACTICE:

1. Identifying any of the 23 GOF design patterns in the given design problem.
2. Design and Implementation of the patterns using Java with appropriate case studies.
3. Creating reusable solution to a design problem using a case study.
4. Use architecture styles like MVC, Pipes and Filters, and Layers to develop computational system.

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, "Design Patterns: Elements of Reusable Object-Oriented Software", Pearson Education, 2005.

2. Frank Buschman, Regine Meunier, Hans Rohnert, Peter Sommerlad and Michael Stal, “Pattern-Oriented Software Architecture: A System of Patterns”, John Wiley and Sons, 2001.

REFERENCES:

1. Martin Fowler, Kent Back, John Brant, William Opdyke, “Refactoring: Improving the Design of Existing Code”, Addison Wesley Professional, 1999.
2. Steven John Metsker and William C. Wake, “Design Patterns in Java”, Addison Wesley, 2006.
3. Eric Freeman, Bert Bates, Kathy Sierra, Elisabeth Robson, “Head First Design Patterns”, O’Reilly, 2004.

18XA13 ADVANCED DATABASE MANAGEMENT SYSTEMS

3 2 0 4

QUERY PROCESSING: Database Catalog - Query Processing Methodology - Query Evaluation - Query Interpretation - Equivalence of Expressions – Selection, Projection and Natural Join Operations - Estimation of Query Processing Cost - Estimation of access costs using Indices - Simple Iteration - Block-Oriented Iteration - Merge-Join Use of an Index - Hash Join - algorithm for executing query operations - Query Optimization. (7)

OBJECT DATABASES: Introduction to Object Relational Data Model - Complex data types- Structured types and Inheritance- Nesting -un nesting of Relations – Query Processing in ORDBMS- Object oriented data model - Object Identity - Persistent Programming Languages - Type and Class Hierarchies and Inheritance - Complex Objects - Object Oriented Database Design - Query Processing in object oriented database-Comparison of Object Oriented and Object Relational databases. (8)

PARALLEL AND DISTRIBUTED DATA BASES: Architecture of parallel databases – Parallel query evaluation, Paralyzing individual operations, Parallel query optimization - Homogeneous and Heterogeneous databases - Architecture of distributed data bases - Storing data in distributed data bases, Distributed Transactions - Concurrency control in Distributed databases - Distributed query processing. (8)

CURRENT DATABASES: Key - Value Stores – Amazon’s DynamoDB, Key -Value Stores (in-memory) : Redis , Column Oriented Store: Google BigTable - Document Oriented Stores – MongoDB - Graph databases: Neo4J. (10)

DATABASE INTEGRATION: Data integration: schema directed data integration - Data exchange: Schema mapping and information preservation - automatic schema matching - Information Preserving XML Schema Embedding. (12)

TUTORIAL PRACTICE:

1. Object Relational Databases - including object orientation features in relational databases and creation of nested relations. Projects using OR databases.
2. Mini projects in distributed databases to acquire hands on practice in fragmentation and replication strategies
3. Active databases - Assignments to create triggers for specifying active rules in relational databases.
4. Spatial databases – Creation and querying of databases which store geographic data such as graphs, maps.

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, “Database System Concepts”, Tata McGraw Hill, 2010.
2. Thomas Connolly and Carolyn Begg, “Database Systems”, Pearson Education, 2010.
3. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, Tata McGraw Hill, 2004.

REFERENCES:

1. Tamer O. Zsu M. and Patrick Valduriez, “Principles of Distributed Database Systems”, Pearson Education, 2011.
2. Elmasri R. and Navathe S. B., “Fundamentals of Database Systems”, Pearson Education, 2017.
3. Gavin Powell, “Beginning XML Databases”, Wiley, 2007.

18XA14 EMBEDDED SYSTEM AND DESIGN

3 2 0 4

INTRODUCTION TO EMBEDDED SYSTEMS: Definition – Examples of Applications – Important characteristics of these applications – real-time system and definitions – real –time system – Common misconceptions – Overview of science of real-time systems and examples of research problems. (6)

HARDWARE FUNDAMENTALS: Microprocessors – Microcontroller - Direct Memory Access – Universal Asynchronous Receiver / Transmitter (UART) – Programmable. Array Logic (PAL) – Application Specific Integrated Circuit (ASIC) – Watch dog Timer. (6)

INTERRUPTS: Interrupt Basics – Saving and Restoring the content - Disabling Interrupts – The Shared–data Problem – Shared–Data bug – Solving Atomic and Critical sections – Interrupt Latency. (5)

EMBEDDED SOFTWARE ARCHITECTURE: Round Robin - Round Robin with interrupts, Example – characteristics – Function - Queue- Scheduling Architecture – Real Time Operating System Architecture. (7)

REAL TIME OPERATING SYSTEMS: Task state, Scheduler Task and Data – Reentrancy, Rules – Semaphores and Shared-data– RTOS Semaphores – Initializing semaphores - Reentrancy and Semaphores – Multiple semaphores - Semaphore problems – variants. (8)

REAL TIME OPERATING SYSTEM SERVICES: Message Queues, Mailboxes and Pipes – Time functions – Events – Memory management – Interrupt Routine in RTOS Environment. (6)

DESIGN USING RTOS: Design Principles – Short Interrupt Routines – RTOS Tasks – Tasks for Priority – Tasks for Encapsulation – Creating and Destroying tasks – Avoidance. (7)

TUTORIAL PRACTICE :

1. Design RTS program using Round Robin method.
2. Design RTS program using semaphore.
3. Design RTS program which uses message queue, mail box, pipe.

Total L:45+T:30=75

TEXT BOOKS :

1. David E Simon, “An Embedded Software Primer “, Pearson Education, 2013.
2. Marilyn Wolf, “Computers as components: principles of embedded computing system design”, Elsevier, 2014

REFERENCES :

1. Jane W S Liu, “Real - time Systems”, Pearson Education, 2012.
2. Arnold Berger, “Embedded System Design: introduction to process, tools and techniques”, Elsevier, 2010

18XA15 INFORMATION SEARCH AND RETRIEVAL

3 0 2 4

INTRODUCTION Overview of IR Systems - Historical Perspectives - Goals of IR - The impact of the web on IR - The role of artificial intelligence (AI) in IR. (3)

TEXT REPRESENTATION Statistical Characteristics of Text Zipf's law - Porter stemmer - Morphology - Index term selection using thesauri - **Basic Tokenizing Indexing -** Stop-word removal and stemming - Inverted indices - Data Structure and File Organization for IR. (7)

RETRIEVAL MODELS Similarity Measures and Ranking - Boolean matching - Extended Boolean models - Ranked retrieval - Vector Space Models - Text-similarity metrics - TF-IDF weighting - Cosine similarity - Probabilistic Models . (10)

QUERY PROCESSING Query Operations and Languages - Query expansion - Experimental evaluation of IR - Performance metrics recall, precision and F-measure. (5)

INFORMATION FILTERING TECHNIQUES Introduction to Information Filtering - Relevance Feedback - Applications of Information Filtering: **Recommender Systems** Collaborative filtering and Content-Based recommendation. (6)

WEB SEARCH IR Systems and the WWW - Search Engines - Spidering - Link analysis Hubs and Authorities - Google Page Rank. (7)

INFORMATION EXTRACTION AND INTEGRATION Extracting data from text - NE Recognition - Co-reference Resolution - Relation Extraction - Event Extraction - Extracting and Integrating specialized information on the web. (7)

TUTORIAL PRACTICE:

1. Designing a Desktop search engine
2. Building a web crawler
3. HITS/Page Rank for ranking of Web Pages
4. Spam detection using personal mails
5. Build a simple Recommender system
6. Designing a personalized Search Engine
7. Identifying near duplicates in web pages
8. Extracting information from web pages

Total L: 45 + T: 30 = 75

TEXT BOOKS

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, “Introduction to Information Retrieval”, Cambridge University Press, 2008.
2. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, “Modern Information Retrieval”, Pearson Education, 2010

REFERENCES

1. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, “Information Retrieval Implementing and Evaluating Search Engines”, MIT Press, 2010.
2. C. J. Van Rijsbergen, “Information Retrieval”, Butterworths, 1979.
3. B. Croft, D.Metzler and T.Strohman, “Information Retrieval”, Pearson Education, 2009.

4. Gerald J Kowalski and Mark T MayBury, “Information Storage and Retrieval systems: Theory and Implementation”, Springer, 2009.
5. Francesco Ricci, Lior Rokach, Bracha Shapira and Paul B. Kantor, “Recommender Systems - Handbook”, Springer, 2010.

18XA16 VIRTUAL REALITY

3 0 2 4

INTRODUCTION TO VR AND AR: Overview of class, logistics, history of VR/AR. (3)

THE GRAPHICS PIPELINE AND OPENGL: Overview and Transformations: rotation, translation, scaling, model view matrix, projection matrix, Lighting and Shading. (6)

OPENGL SHADING LANGUAGE (GLSL):GLSL vertex and fragment shaders. (6)

THE HUMAN VISUAL SYSTEM: Perception of depth, color, contrast, resolution, Stereo Rendering. (6)

HEAD MOUNTED DISPLAY OPTICS: Magnifier designs, stereo rendering for HMDs, lens distortion correction, advanced HMD optics. (6)

INERTIAL MEASUREMENTS UNITS: gyros, accelerometers, magnetometers, sensor fusion, complementary filter, Arduino (6)

POSITIONAL TRACKING: Tracking with the light house, advanced positional tracking.- Spatial Sound (6)

PANORAMIC IMAGING AND CINEMATIC VR: VR Engines and Other Aspects of VR (latency, eye tracking, post-rendering warp) (6)

TUTORIAL PRACTICE:
1. Lab: Hello, WebGL!
2. Lighting and shading with GLSL
3. Stereo rendering, anaglyph
4. Building Own Head Mounted Display
5. Build Your Own IMU, Arduino Programming
6. Positional Tracking
7. Spatial Sound
8. Content creation with unity (Optional)

Total L: 45 + T: 30 = 75

TEXT BOOKS:
1. Marschner, Shirley, “Fundamentals of Computer Graphics”, 4th Edition, CRC Press, 2016.
2. La Valle, “Virtual Reality”, Cambridge University Press, 2016.

REFERENCES:
1. Jos Dirksen, "Learning Three.js: The JavaScript 3D Library for WebGL", Packt Publishing, 2013
2. Jacobo Rodriguez, "GLSL Essentials: Enrich your 3D scenes with the power of GLSL!", Packt Publishing, 2013.

OPEN ELECTIVES

18XO01 CRYPTOGRAPHY

3 2 0 4

MATHEMATICS OF CRYPTOGRAPHY: Fundamental theorem of arithmetic (statement only) - Divisibility - Euclidean and Extended Euclidean algorithms, Primes - Euler totient function- Fermat’s little theorem, Modular arithmetic- Computing modular inverse – modular exponentiation - efficient algorithms, generators and primitive roots in groups - Discrete log problem - Chinese remainder theorem. (9)

BASIC CRYPTOGRAPHIC TECHNIQUES: Encryption and Decryption, Classical ciphers- Substitution ciphers- Polyalphabetic ciphers – one time pad – transposition ciphers – security of classical ciphers. (8)

SYMMETRIC KEY CRYPTOGRAPHY: Stream cipher – Block ciphers – DES – Modes of operation. (6)

PUBLIC KEY CRYPTOGRAPHY: Concept of public key cryptography – RSA cryptosystem - cryptanalysis against RSA - Discrete log problem, ElGamal cryptosystem. (6)

DATA INTEGRITY TECHNIQUES: Symmetric techniques - Cryptographic hash functions – MAC, asymmetric techniques – Digital signatures – RSA signatures, the ElGamal signature scheme, DSA. (8)

AUTHENTICATION AND KEY DISTRIBUTION PROTOCOLS: Password authentication, Challenge and response –Fiat Shamir protocol, Symmetric key distribution – KDC, Kerberos, Diffie- Hellman key pre-distribution, Public key distribution- digital certificates. (8)

TUTORIAL PRACTICE:

1. Implementation of Extended Euclidean algorithms
2. Implementation of modular inverse – modular exponentiation
3. Implementation of Polyalphabetic ciphers.
4. Implementation of one time pad
5. Implementation of RSA cryptosystem
6. Implementation of ElGamal cryptosystem.
7. Implementation of ElGamal signature scheme.
8. Implementation of Fiat Shamir protocol.
9. Implementation of Diffie- Hellman key pre-distribution

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Douglas R. Stinson, “Cryptography Theory and Practice”, CRC Press, 2006.
2. Behrouz A. Forouzan, “Cryptography and Network Security”, Tata McGraw Hill, 2007.
3. Victor Shoup, “A Computational introduction to Number Theory and Algebra”, Cambridge university Press, 2009.

REFERENCES:

1. William Stallings, “Cryptography and Network Security - Principles & Practice”, Prentice Hall, 2006.
2. Alfred J., Menezes, Paul C., Van Oorschot and Scott A Vanstone, “Hand Book of Applied Cryptography”, CRC Press, 2001.

18XO02 NUMERICAL ANALYSIS

3 2 0 4

TYPES OF ERRORS: Different types of errors. (3)

SOLUTION OF ALGEBRAIC EQUATIONS: Bisection method, method of false position , Newton Raphson method, modified Newton Raphson method , Graeffe’s method, Bairstow’s method. (8)

SOLUTION OF ALGEBRAIC SIMULTANEOUS EQUATIONS: Gauss elimination ,Gauss Jordan, Crout’s method - Cholesky method ,Gauss Jacobi method, Gauss – Seidel method. (8)

EIGENVALUES AND EIGENVECTORS: Power method ,inverse power method , Jacobi method (4)

FINITE DIFFERENCES AND INTERPOLATION: Finite difference operators – . Interpolation: Newton’s divided difference formula , Lagrange’s interpolation formula , Newton’s-Gregory forward and backward interpolation. (8)

DIFFERENTIATION AND INTEGRATION: Numerical differentiation using Newton’s-Gregory forward and backward polynomials. Numerical Integration: Gaussian Quadrature , Trapezoidal rule , Simpson’s one third rule. (6)

ORDINARY DIFFERENTIAL EQUATIONS: Taylor series method , Euler method and its Modifications, Runge-Kutta methods , Runge Kutta Fehlberg method, multi step methods: Adams fourth-order formula , Adams-Moulton method, boundary value problems : Shooting method. (8)

TUTORIAL PRACTICE:

1. Solution of Non-linear equations (Bisection method, Regula Falsi method, Graeffe’s method, Bairstow’s method)
2. Solution of system of linear equations (Gauss-Jordan elimination, Gauss Jacobi and Gauss Seidel methods)
3. Finding Eigenvalues and Eigenvectors(Power method and Jacobi method)
4. Interpolation (Newton forward, Newton backward, Newton divided difference, Lagrange’s interpolation)
5. Numerical integration (Trapezoidal rule, Simpson’s one-third rule, Gaussian quadrature)
6. Solution of ordinary differential equations(Euler and modified Euler methods, Runge-Kutta method and Milne’s method)

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Steven C. Chapra and Raymond P. Canale, “Numerical Methods for Engineers”,Tata McGraw Hill, 2006.
2. Curtis F. Gerald and Patrick O. Wheatly, “Applied Numerical Analysis”, Pearson Education, 2003.

REFERENCES:

1. Richard L.Burden and J.Dougglas Faires, “Numerical Analysis”, Thomson Brooks/Cole, 2005.
2. Brian Bradie, “A Friendly Introduction to Numerical Analysis”, Pearson Education, 2006.

18XO03 CYBER SECURITY

3 2 0 4

INTRODUCTION TO CYBER CRIME: Cyber Crime and Information Security-Types of cyber crime- Nature of crime-Categories of cyber crime-Social engineering-Identify theft. (6)

CYBERCRIME FUNDAMENTALS & ISSUES: Unauthorized access to computers, Internet hacking & Cracking, Viruses & malicious code, Software piracy- Cyberstalking - Social media crimes-Understanding social media marketing - Best practices with use of Social marketing tools - Case studies. (8)

HACKING NETWORKS: Web application & Web server hacking - Hacking wireless networks: Standards – protocols-Architectures – Vulnerability – Network protection and Security devices. (8)

INVESTIGATION: Cybercrime Investigations-Evidence handling - Collection & Preservation -E-mail & Mobile tracking - IP tracking - Password cracking and Evidence recovery. (8)

DEFENSE AND ANALYSIS TECHNIQUES: Threat, Types of Threat, Vulnerabilities, Controls and Counter measures, Attacks examples – Reconnaissance attack, Access attacks, Masquerading, IP Spoofing, and Denial of Service attack, Distributed Denial of Service- Honeypots – DNS-Firewall. **(**8)

LAWS & ACTS: Legal perspective-India & global, IT ACT, CrPC, IPC, IPR in cyberspace, Cyber ethics, Evidence Act & Privacy Act-Guidelines and computer usage policy. (7)

TUTORIAL PRACTICE:

1. Hacking web applications
2. Hacking web server
3. Network hacking
4. Database hacking
5. Password cracking
6. Mobile device tracking
7. IP tracking

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. James Graham, Richard Haward and Ryan Olson, “Cyber Security Essentials” CRC Press, 2011.
2. Charles P. Pfleeger and Shari Lawrence Pfleeger, “Analyzing Computer Security – A threat/vulnerability / Counter measure approach”, Pearson Education, 2014.

REFERENCES:

1. Michael T Simpson, Kent Backman and James E.Corley “Hands-On Ethical hacking and Network Defense” Cengage Learning, 2013.
2. Nina GodBole and Sunit Belapure, “Cyber Security-Understanding cyber crimes, computer forencics, and legal perspective, Wiley, 2011.
3. Jennifer L. Bayuk, Jason Healey, Paul Rohmeyer, Marcus H.Sachs, Jeffrey Schmidt and Joseph Weiss, “Cyber Security Policy Guidebook”, John Wiley & Sons, 2012.
4. William Stallings, “Cryptography and Network Security Principles and Practice”, Pearson Education, 2014.

18XO04 ENTERPRENEURSHIP

3 2 0 4

INTRODUCTION TO ENTREPRENEURSHIP: Definition – Characteristics and Functions of an Entrepreneur – Common myths about entrepreneurs – Importance or Entrepreneurship. Seminar in R5 & R6. (5)

CREATIVITY AND INNOVATION: The role of creativity – The innovation Process – Sources of New Ideas – Methods of Generating Ideas – Creative Problem Solving – Entrepreneurial Process. (6)

DEVELOPING AN EFFECTIVE BUSINESS MODEL: The Importance of a Business Model – Starting a small scale industry - Components of an Effective Business Model. (5)

APPRAISAL OF PROJECTS: Importance of Evaluating Various options and future investments- Entrepreneurship incentives and subsidies – Appraisal Techniques. (8)

FORMS OF BUSINESS ORGANIZATION: Sole Proprietorship – Partnership – Limited liability partnership - Joint Stock Companies and Cooperatives. (4)

FINANCING THE NEW VENTURE: Determining Financial Needs – Sources of Financing – Equity and Debt Funding – Case studies in Evaluating Financial Performance. **(**8)

THE MARKETING FUNCTION: Industry Analysis – Competitor Analysis – Marketing Research for the New Venture – Defining the Purpose or Objectives – Gathering Data from Secondary Sources – Gathering Information from Primary Sources – Analyzing and Interpreting the Results – The Marketing Process**.** (5)

INTELLECTUAL PROPERTY PROTECTION AND ETHICS: Patents – Copyright - Trademark- Geographical indications – Ethical and social responsibility and challenges. (4)

TUTORIAL PRACTICE:
Case studies

Total L: 45+T: 30=75

TEXT BOOKS:
1. Donald F.Kuratko and Richard M.Hodgetts, "Entrepreneurship : Theory, Process and Practice", South-Western, 2007.
2. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2010.

REFERENCES:
1. S.L.Gupta and Arun Mittal, "Entrepreneurship Development", International Book House, 2012.
2. G. S. Sudha, "Management and Entrepreneurship Development", Indus Valley Publication, 2009.
3. V. Badi and N. V. Badi , "Business Ethics", R, Vrinda Publication (P) Ltd., 2012.
4. Prasanna Chandra, "Projects- Planning, Analysis, Financing, Implementation and review", TATA McGraw Hill, 2012.

18XO05 HUMAN MACHINE INTERFACE DESIGN

3 2 0 4

INTRODUCTION: Overview – Usability – Machine: Computer – PC – GUI – Networks – Mobile – Guidelines and Principles- Future. (7)

HUMAN PERCEPTION AND PRESENTATION: Perception – Gestalt Presentation – Typography – Color- Graphic Design – Displays – Paper – Output Devices – Information Visualization. (10)

HUMAN BODY AND DEVICE DESIGN: Input Devices and Ergonomics – Virtual Reality. (8)

HUMAN COGNITION: Keystroke Level Modeling – Time Scale – Illusion of Multi Tasking – Hypothesis Testing - Statistical Significance – metaphor – Interaction Styles. (10)

USABILITY: Users: Mindset – Subject Running Techniques– Usability Studies – Usability Analysis – Specifying and Prototyping – Task Analysis. (5)

USER INTERFACE: Events and Handlers – Responsiveness – Speech and Multimodal –Case Study. (5)

TUTORIAL PRACTICE:
1. Analyzing a Usability Problem on Machines
2. Information Visualization
3. Time and Motion Study of GUI
4. Widget Survey
5. Sketch People and Task Decomposition

Total L: 45 + T: 30 = 75

TEXT BOOKS:
1. Ben Shneiderman, Catherine Plaisant, Maxine S.Cohen, Steven M.Jacobs, Nicholas Diakopoulos and Niklas Elmqvist, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", Addison Wesley, 2017.

REFERENCES:
1. Preece, Rogers and Sharp, "Interaction Deign", Wiley, 2015.
2. Jenifer Tidwell, "Designing Interfaces", O'Reilly, 2011

18XO06 INTERNET OF THINGS

3 2 0 4

INTRODUCTION to IOT: smart connectivity - smart technology – smart TVs - smart appliances - smart homes - smart cars - smart cities. (5)

RFID: Automatic identification systems - Features of RFID systems - fundamental operating principles - physical principles of RFID systems - Readers - contactless smart cards. (6)

NFC: Introduction to near field communication - NFC data exchange format - NDEF messages on android - NFC operating modes - reader/writer mode - peer to peer mode - card emulation mode - peer to peer exchanges using NFC on android. (6)

Hardware Devices: Types of Sensors – Interfacing (8)

ARDUINO: Basics of sensors and actuators - The Arduino microcontroler platform - reading from sensors - talking to android phone - connecting to internet - read and write NDEF messages using arduino NDEF library. (10)

RASPBERRY PI: setup and management - networking - operating system - python basics - python lists and dictionaries - general pupose input output - controlling hardware. (10)

TUTORIALS PRACTICE:

1. Send data from Arduino to internet.
2. Perform data encryption using Arduino.
3. Running program automatically on startup of Raspberry Pi.
4. Running program automatically at regular intervals on Raspberry Pi.

Total L: 45 + T: 30 = 75

TEXT BOOKS :

1. Tom Igoe, Don Coleman and Brian Jepson, "Beginning NFC", OReilly, 2014
2. Klaus Finkenzeller, "RFID Handbook", Wiley, 2010
3. Charalampos Doukas, "Building Internet of Things with the Arduino", Create space, 2012

REFERENCES :

1. Michael Miller, "The Internet of Things" , Pearson Education, 2015.
2. Massimo Banzi, "Getting Started with Arduino", Shroff Publishers & Distributors, 2014
3. Simon Monk, "Programming Arduino: getting started with sketches" McGraw Hill, 2012
4. Vedat Coskun, Kerem Ok, Busra Ozdenizci, "Near Field Communication from theory to practice" Wiley, 2011
5. Simon Monk, "Raspberry Pi Cookbook", Oreilly, 2014
6. A Richard Wentk, "Teach yourself visually Raspberry Pi", Wiley, 2014
7. Matt Richardson, Shawn Wallace, "Getting started with Raspberry Pi" Oreilly, 2014