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S.P. Mandali's

RAMNARAIN RUIA AUTONOMOUS COLLEGE

Syllabus for: M.Sc. Information Technology

Program: M.Sc..

Course Code: Information Technology (RPSIT)

(Choice Based Credit System (CBCS) with effect from academic year 2019-20)

PREAMBLE

The IT industry has emerged as one of the fastest growing sectors of Indian economy. The unambiguous growth of IT industry is rapidly advancing the industry requirements and technologies. The students too these days are thinking beyond career in the industry and aiming for research opportunities. The proposed curriculum expertly produces students to succeed in IT Industry, which are projected to be amongst the fastest growing field in coming decades. New technology products and information systems always combine technical quality and smart business strategy. The Post Graduate Degree in IT with an emphasis on utilizing information technologies for productivity and competitiveness prepares students to succeed in their career.

A real genuine attempt has been made while designing the M.Sc. Information Technology course structure. Not only does it prepare the students for a career in Software industry, it also motivates them towards further studies and research opportunities. All subjects are proposed to have theory as well as practical in latest tools used in Industry. Any student taking this course will get exposure to basics, advanced and emerging trends in the subject.

We wholeheartedly thank all experts who shared their valuable feedbacks and suggestions in order to improvise the contents, we have sincerely attempted to incorporate each of them. We further thank members of Subject Board for their confidence in us.

MSC INFORMATION TECHNOLOGY SYLLABUS

CREDIT BASED SYSTEM AND GRADING SYSTEM

ACADEMIC YEAR 2019-2020

SEMESTER I					
COURSE CODE	**COURSE TITLE**	**CREDITS**	**PRACTICAL COURSE**	**CREDITS**	**TOTAL CREDITS**
RPSIT101	Advanced Database Management Systems	4	RPSITP101	2	6
RPSIT102	Distributed Systems	4	RPSITP102	2	6
RPSIT103	Data Analytics	4	RPSITP103	2	6
RPSIT104	Software Testing	4	RPSITP104	2	6

SEMESTER II					
COURSE CODE	**COURSE TITLE**	**CREDITS**	**PRACTICAL COURSE**	**CREDITS**	**TOTAL CREDITS**
RPSIT201	Data Mining	4	RPSITP201	2	6
RPSIT202	Mobile & Enterprise Networks	4	RPSITP202	2	6
RPSIT203	Artificial Intelligence	4	RPSITP203	2	6
RPSIT204	Virtualization & Cloud Computing	4	RPSITP204	2	6

SEMESTER III					
COURSE CODE	**COURSE TITLE**	**CREDITS**	**PRACTICAL COURSE**	**CREDITS**	**TOTAL CREDITS**
RPSIT301	Embedded Systems	4	RPSITP301	2	6
RPSIT302	Big Data Analytics	4	RPSITP302	2	6
RPSIT303	Ethical Hacking	4	RPSITP303	2	6
RPSIT304	Digital Forensics	4	RPSITP304	2	6

SEMESTER IV					
COURSE CODE	**COURSE TITLE**	**CREDITS**	**PRACTICAL COURSE**	**CREDITS**	**TOTAL CREDITS**
RPSIT401	Information Security Management	4	RPSITP401	2	6
RPSITP402	Project				4
RPSITP403	Internship (Approx 200 - 250 Hrs)				14

SEMESTER I - THEORY

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT101	**RPSIT101** **ADVANCED DATABASE MANAGEMENT SYSTEMS**	**4**	**4**

Course Objective:

- Understand relational and object oriented database technology for building applications for the current trend.
- Evaluate a business situation and designing & building a database applications.
- Explore non-relational database systems and structures.
- To learn and experiment advanced database models and provide them knowledge to take decisions concerning implementation issues.

Expected Learning Outcome:

Students completing this course will be able to:

- Analyze compare and evaluate alternative database architectures and models in different application contexts.
- Get promising research direction in advanced topics and techniques.
- Use various database tools and software's for designing database applications.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	The Extended Entity Relationship Model and Object Model: The ER model revisited, Motivation for complex data types, User defined abstract data types and structured types, Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization, Relationship types of degree higher than two.	12 L
II	Object-Oriented Databases: Overview of Object-Oriented concepts, Object identity, Object structure, and type constructors, Encapsulation of operations, Methods, and Persistence, Type hierarchies and Inheritance, Type extents and queries, Complex objects; Database schema design for OODBMS; OQL, Persistent programming languages; OODBMS architecture and storage issues; Transactions and Concurrency control, Example of ODBMS	12 L
III	Object Relational and Extended Relational Databases: Database design for an ORDBMS - Nested relations and collections; Storage and access methods, Query processing and Optimization; An overview of SQL3, Implementation issues for extended type; Systems comparison of RDBMS, OODBMS, ORDBMS	12 L
IV	Parallel and Distributed Databases and Client-Server Architecture: Architectures for parallel databases, Parallel query evaluation; Parallelizing individual operations, Sorting, Joins; Distributed database concepts, Data fragmentation, Replication, and allocation techniques for distributed database design; Query processing in distributed databases; Concurrency control and Recovery in distributed databases. An overview of Client-Server architecture	12 L
V	Databases on the Web and Semi Structured Data: Web interfaces to the Web, Overview of XML; Structure of XML data, DTD, XML Schema, XQuery, XSLT, Storage of XML data, XML applications, XML DOM, The semi structured data model, Implementation issues, Indexes for text data Enhanced Data Models for Advanced Applications: Active database concepts. Temporal database concepts.; Spatial	12 L

	databases, Concepts and architecture; Deductive databases and Query processing; Mobile databases, Geographic information systems.	

References:

1. Elmasri and Navathe, "Fundamentals of Database Systems", Pearson Education, 6th edition.
2. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw-Hill,3rd edition
3. Korth, Silberchatz, Sudarshan , "Database System Concepts", McGraw-Hill, 6th edition.
4. Peter Rob and Coronel, "Database Systems, Design, Implementation and Management", Thomson Learning, 8th edition.
5. C.J.Date, Longman, "Introduction To Database Systems", Pearson Education, 8th edition.

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP101	**PRACTICAL OF RPSITP101 (ADBMS)**	**2**	**2**
	1. Horizontal fragmentation of database. 2. Vertical fragmentation of database 3. Creating Replica of database. 4. Create Temporal Database. 5. Inserting and retrieving multimedia objects in database (Image / Audio /Video). 6. Implement Active database using Triggers 7. Create ORDBMS Application 8. Implement and retrieve records from a Spatial Database 9. Create XML Parser 10. Using XML DOM Traverse XML Document. 11. Create an XML Application using database and any programming language (Java / VB.NET - ASP.NET, C#-ASP.NET). 12. Prolog programming.		

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT102	**RPSIT102 DISTRIBUTED SYSTEMS**	**4**	**4**

Course Objective:

- To provide an introduction to the fundamentals of distributed computer systems.
- To discuss data transmission, IPC mechanisms in distributed systems, Remote procedure calls and Remote Method Invocation.
- To expose students to current technologies used to build distributed computing infrastructures with various computing principles.

Expected Learning Outcome:

Students completing this course will be able to:

- Develop a familiarity with distributed file systems.
- Describe important characteristics of distributed systems and the salient architectural features of such systems.

- Describe the features and applications of important standard protocols which are used in distributed systems.
- Gain practical experience of inter-process communication in a distributed environment.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	Characterization Of Distributed Systems: Introduction, Examples ofDistributed Systems, Trends In Distributed Systems, Focus OnResource Sharing, Challenges, Case Study: The World Wide Web. System Models: Physical Models, Architectural Models, Fundamental Models	12 L
II	Networking And Internetworking: Types Of Network, Network Principles, Internet Protocols, Case Studies: Ethernet, Wifi And Bluetooth. Interprocess Communication: The Api For The Internet Protocols, External Data Representation And Marshalling,Multicast Communication, Network Virtualization: Overlay Networks, CaseStudy: MPI	12 L
III	Remote Invocation: Request-Reply Protocols, Remote Procedure Call, Remote Method Invocation, Case Study: Java RMI Indirect Communication: Group communication, Publish-subscribesystems, Message queues, Shared memory approaches Web Services: Web services, Service descriptions and IDL for webservices, A directory service for use with web services, XML security, Coordination of web services, applications of web services.	12 L
IV	Coordination And Agreement: Distributed mutual exclusion Elections Coordination and agreement in group communication, Consensus and related problems Name Services: Name services and the Domain Name System, Directory services, Case study: The Global Name Service, Case study: The X.500 Directory Service. Time And Global States: Clocks, events and process states, Synchronizing physical clocks , Logical time and logical clocks, Global states, Distributed debugging	12 L
V	Distributed Transactions: Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks. Replication: System model and the role of group communication, Fault-tolerant services, Case studies of highly available services: The gossip architecture, Bayou and Coda, Transactions with replicated data Mobile And Ubiquitous Computing: Association, Interoperation, Sensing and context awareness, Security and privacy, Adaptation, Case study: Cooltown	12 L

Main References:

1. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair , Distributed Systems - Concepts and Design (Unit I-Unit VI), Pearson Education, 5th edition
2. A. Taunenbaum, Maarten van Steen "Distributed Systems: Principles and Paradigms",2nd edition

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP102	**PRACTICAL OF RPSITP102 (DISTRIBUTED SYSTEMS)**	**2**	**2**
	1. Implement the concept for sharing the resources using distributed system. 2. Write a program for implementing Client Server communication model. 3. Write a program to show the object communication using RMI. 4. Show the implementation of Remote Procedure Call. 5. Show the implementation of web services. 6. Write a program to execute any one mutual exclusion algorithm. 7. Write a program to implement any one election algorithm. 8. Show the implementation of any one clock synchronization algorithm. 9. Write a program to implement two phase commit protocol. 10. Implement the concept of distributed file system architecture		

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT103	**RPSIT103 DATA ANALYTICS**	**4**	**4**

Course Objective:
To develop data-analytics capability in the business community.

Expected Learning Outcome:
Students completing this course will be able to:

- Analyze main statistical features of complex datasets.
- Understand how to analyse, characterize empirically complex data.
- Use the outcome of data-analytics to draw conclusions in real world.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	PART I : COMPUTING Statistics in Modern day, C : Lines, Variables and their declarations, Functions, The debugger , Compiling and running, Pointers , Arrays and other pointer tricks, Strings Databases :Basic queries , Doing more with queries, Joins and subqueries, On database design , Folding queries into C code	12 L
II	Matrices and models :The GSL's matrices and vectors apo_dat, Shunting data, Linear algebra, Numbers, gsl_matrix and gsl_vector internals, Models, Graphics: plot , Some common settings, From arrays to plots, A sampling of special plots, Animation, On producing good plots, Graphs--nodes and flowcharts, Printing and LATEX	12 L
III	More coding tools : Function pointers , Data structures, Parameters, Syntactic sugar, More tools PART II : STATISTICS Distributions for description : Moments ,Sample distributions, Using the sample distributions , Non-parametric description	12 L

IV	Linear projections: Principal component analysis, OLS and friends, Discrete variables, Multilevel modeling Hypothesis testing with the CLT: The Central Limit Theorem, Meet the Gaussian family, Testing a hypothesis, ANOVA,Regression , Goodness of fit.	12 L
V	Maximum likelihood estimation: Log likelihood and friends, Description: Maximum likelihood estimators, Missing data, Testing with likelihoods Monte Carlo : Random number generation, Description: Finding statistics for a distribution, Inference: Finding statistics for a parameter, Drawing a distribution, Non-parametric testing.	12 L

Main References:

1. Modeling with Data: Tools and Techniques for Scientific Computing Ben Klemens, Princeton University Press.
2. Computational Statistics, James E. Gentle, Springer,April 2009.
3. Computational Statistics, Second Edition, Geof H. Givens and Jennifer A. Hoeting, WileyPublications

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP103	**PRACTICAL OF RPSITP103 (DATA ANALYTICS)**	**2**	**2**
	1. Some SQL queries based on the 1st Unit. 2. Implementing GSL matrix and vectors 3. Graph Plotting 4. Implement the statistical distributions 5. Implement regression and goodness of fit 6. Implement testing with likelihood 7. Generate random numbers using Monte Carlo method 8.Implementing Non-Parametric testing 9.Drawing an Inference 10.Implement Non-parametric Testing		

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT104	**RPSIT104 SOFTWARE TESTING**	**4**	**4**

Course Objective:

- The course objective is to make students aware of how testing are done in every phase through small small strategy for both manual & automated.

Expected Learning Outcome:

Students completing this course will be able to:

- Analyze requirements to determine appropriate testing strategies.
- Design and implement comprehensive test plans
- Instrument code appropriately for a chosen test technique
- Apply a wide variety of testing techniques in an effective and efficient manner
- Compute test coverage and yield according to a variety of criteria

UNITS	COURSE CONTENTS	NO. OF LECTURES

I	Test Basics: Introduction, Testing in the Software Lifecycle, Specific Systems, Metrics and Measurement, Ethics Testing Processes: Introduction, Test Process Models, Test Planning and Control, Test Analysis and Design, Non-functional Test Objectives, Identifying and Documenting Test Conditions, Test Oracles, Standards, Static Tests, Metrics, Test Implementation and Execution, Test Procedure Readiness, Test Environment Readiness, Blended Test Strategies, Starting Test Execution, Running a Single Test Procedure, Logging Test Results, Use of Amateur Testers, Standards, Metrics, Evaluating Exit Criteria and Reporting, Test Suite, Defect Breakdown, Confirmation Test Failure Rate, System Test Exit Review, Standards, Evaluating Exit Criteria and Reporting Exercise, System Test Exit Review, Test Closure Activities	12 L
II	Test Management: Introduction, Test Management Documentation, Test Plan Documentation Templates, Test Estimation, Scheduling and Test Planning, Test Progress Monitoring and Control, Business Value of Testing, Distributed, Outsourced, and Insourced Testing, Risk-Based Testing, Risk Management, Risk Identification, Risk Analysis or Risk Assessment, Risk Mitigation or Risk Control, Risk Identification and Assessment Results, Risk-Based Testing throughout the Lifecycle, Risk-Aware Testing Standards, Risk-Based Testing Exercise, Project Risk By-Products, Requirements Defect By-Products, Test Case Sequencing Guidelines, Failure Mode and Effects Analysis, Test Management Issues	12 L
III	Test Techniques Introduction, Specification-Based, Equivalence Partitioning, Avoiding Equivalence Partitioning Errors, Composing Test Cases with Equivalence Partitioning, Equivalence Partitioning Exercise, Boundary Value Analysis, Examples of Equivalence Partitioning and Boundary Values, Non-functional Boundaries, Functional Boundaries, Integers, Floating Point Numbers, Testing Floating-point Numbers, Number of Boundaries, Boundary Value Exercise, Decision Tables, Collapsing Columns in the, Combining Decision Table Testing with Other Techniques, Nonexclusive Rules indecision Tables, 4 Decision Table Exercise, Decision TableExercise Debrief, State-Based Testing and State Transition Diagrams, Superstates and Substates, State Transition Tables, Switch Coverage, State Testing with Other Techniques, State Testing Exercise, State Testing Exercise Debrief, Requirements-Based Testing Exercise, Requirements-Based Testing Exercise Debrief, Structure-Based, Control-Flow Testing, Building Control-Flow Graphs, Statement Coverage, Decision Coverage, Loop Coverage, Hexadecimal Converter Exercise, HexadecimalConverterExerciseDebrief,ConditionCoverage, Decision/Condition Coverage, Modified Condition/DecisionCoverage(MC/DC), Multiple Condition Coverage, Control-Flow Exercise, Control-Flow Exercise Debrief, Path Testing, LCSAJ,Basis Path/Cyclomatic Complexity Testing, CyclomaticComplexity Exercise, Cyclomatic Complexity Exercise Debrief, Final Word on Structural Testing, Structure-Based Testing Exercise, Structure-Based Testing Exercise Debrief, Defect-andExperience-Based, Defect Taxonomies, Error Guessing, Checklist	12 L

	Testing, Exploratory Testing, Test Charters, Exploratory Testing Exercise, Software Attacks, An Example of Effective Attacks, Other Attacks, Software Attack Exercise, Software Attack Exercise Debrief, Specification-, Defect-, and Experience-Based Exercise, Specification-, Defect-,and Experience-Based Exercise Debrief, Common Themes, Static Analysis, Complexity Analysis, Code Parsing Tools, Standards and Guidelines, Data-Flow Analysis, Set-Use Pairs, Set-Use Pair Example, Data-Flow Exercise, Data-Flow Exercise Debrief, Data-Flow Strategies, Static Analysis for Integration Testing, Call-Graph Based Integration Testing, McCabe Design Predicate Approach to Integration Testing, Hex Converter Example, McCabe Design Predicate Exercise, McCabe Design Predicate Exercise Debrief, Dynamic Analysis, Memory Leak Detection, Wild Pointer Detection, API Misuse Detection.	
IV	Tests of Software Characteristics Introduction, Quality Attributes for Domain Testing, Accuracy, Suitability, Interoperability, Usability, Usability Test Exercise, Usability Test Exercise Debrief, Quality Attributes for Technical Testing, Technical Security, Security Issues, Timely Information, Reliability, Efficiency, Multiple Flavors of Efficiency Testing,Modelling the System, Efficiency Measurements, Examples of Efficiency Bugs, Exercise: Security, Reliability and Efficiency, Exercise: Security, Reliability, and Efficiency Debrief, Maintainability, Sub characteristics of Maintainability, Portability, Maintainability and Portability Exercise. Reviews Introduction, The Principles of Reviews, Types of Reviews, Introducing Reviews, Success Factors for Reviews, Deutsch'sDesign Review Checklist, Marick's Code Review Checklist, TheOpen Laszlo Code Review Checklist, Code Review Exercise,Deutsch Checklist Review Exercise. Incident Management Introduction, When Can a Defect Be Detected? Defect Lifecycle,Defect Fields, Metrics and Incident Management, CommunicatingIncidents, Incident Management Exercise.	12 L
V	Standards and Test Process Improvement Introduction, Standards Considerations, Test ImprovementProcess, Improving the Test Process,Improving the Test Process with TMM, Improving the Test Process with TPI, Improving the Test Process with CTP, Improving the Test Process with STEP, Capability Maturity Model Integration, CMMI, Test ImprovementProcess Exercise. Test Techniques Introduction, Test Tool Concepts, The Business Case for Automation, General Test Automation Strategies, An Integrated Test System Example, Test Tool Categories, Test Management Tools, Test Execution Tools, Debugging, Troubleshooting, FaultSeeding,and Injection Tools, Static and Dynamic Analysis Tools, Performance Testing Tools, Monitoring Tools, Web Testing Tools, Simulators and Emulators, Keyword-Driven Test Automation, Capture/Replay Exercise, Capture/Replay Exercise Debrief, Evolving from Capture/Replay, The Simple Framework Architecture, Data-Driven Architecture, Keyword-Driven Architecture, Keyword Exercise, Performance Testing, Performance Testing Exercise.	12 L

	People Skills and Team Composition Introduction, Individual Skills, Test Team Dynamics, Fitting Testing within an Organization, Motivation, Communication.	

Main References:

1. Advanced SoftwareTesting—Vol. 3 by Rex Black and• Jamie L. Mitchell, Rocky Nook Publication,
2. Advanced Software Testing Vol. 2 by Rex Black, Rocky Nook Publication, 2008
3. W.E. Perry, "Effective Methods for Software Testing", John Wiley, 3rd edition.
4. Kaner C., Nguyen H., Falk J., "Testing Computer Software", John Wiley, 2nd edition.
5. Boris Beizer, "Software Testing Techniques", Dreamtech, 2nd edition
6. Louise Tamres, "Introducing Software Testing", Pearson Education,2002.

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP104	**PRACTICAL OF RPSITP104 (SOFTWARE TESTING)**	**2**	**2**
	Prepare Test case scenario and Test report on following practicals 1. Create a Script by Recording Using Testing Tool Selenium. 2. Create a Script Manually with Firebug Using Testing Tool Selenium 3. Create a WebDriver script that would • fetch homepage • verify its title • print out the result of the comparison • close it before ending the entire program. • Using Testing Tool Selenium 4. Locating elements in WebDriver by using the "findElement(By.*locator*())" Using Testing Tool Selenium 5. Create a Script for Closing and Quitting Browser Windows Using Testing Tool Selenium. 6. Create Switching Between Pop-up Windows Using Testing Tool Selenium. 7. Create a small GUI showing Hello World Using Testing Tool AutoIT. 8. Write a script to open a notepad & write some text into it Using Testing Tool AutoIT. 9. Write a script using input box & switch case to validate the input taken Using Testing Tool AutoIT 10. Write a script to create a GUI having two buttons. • On the click of first button msg box should appear with some msg • On the click of second button another GUI should open which should have a button • On the click of that button msgbox should appear		

SEMESTER II - THEORY

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT201	**RPSIT201 DATA MINING**	**4**	**4**

Course Objective:

- To provide students with an overview of the methodologies and approaches to data mining.
- To evaluate different models used for OLAP and data pre-processing.
- To provide the students with practice on applying data mining solutions using common data mining software tool.

Expected Learning Outcome:

Students completing this course will be able to:

- Interpret the contribution of data warehousing and data mining to the decision support level of organizations.
- Do research in the area of data mining and related applications.
- Categorize and carefully differentiate between situations for applying different data mining techniques: mining frequent pattern, association, correlation, classification, prediction, and cluster analysis.
- Design and implement systems for data mining using data mining tools.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	Introduction: Basics of data mining, related concepts, Data mining techniques. Data: Introduction, Attributes, Data Sets, and Data Storage, Issues Concerning the Amount and Quality of Data, Knowledge Representation: Data Representation and their Categories: General Insights, Categories of Knowledge Representation, Granularity of Data and Knowledge Representation Schemes, Sets and Interval Analysis, Fuzzy Sets as Human-Centric Information Granules, Shadowed Sets, Rough Sets, Characterization of Knowledge Representation Schemes, Levels of Granularity and Perception Perspectives, The Concept of Granularity in Rules.	12 L
II	Data Preprocessing: Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation. Mining Frequent Patterns, Associations, and Correlations: Basic Concepts, Efficient and Scalable Frequent Itemset Mining Methods, Mining Various Kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining	12 L
III	Classification and Prediction: What Is Classification?, What Is Prediction?, Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back-propagation, Support Vector Machines, Associative Classification: Classification by Association Rule Analysis, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error Measures, Evaluating the Accuracy of a Classifier or Predictor, Ensemble Methods Increasing the Accuracy, Model Selection.	12 L

IV	Cluster Analysis: What Is Cluster Analysis?, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis	12 L
V	Graph Mining, Social Network Analysis, and Multirelational Data Mining: Graph Mining, Social Network Analysis, Multirelational Data Mining. Mining Object, Spatial, Multimedia, Text, and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.	12 L

References:

1. M. H. Dunham. Data Mining: Introductory and Advanced Topics. Pearson Education. 2010. (Unit I)
2. Krzysztof J. Cios,W. Pedrycz,R. W.Swiniarski,L.A. Kurgan," Data Mining" A Knowledge DiscoveryApproach", Springer (Unit I).
3. J. Han and M. Kamber, " Data Mining: Concepts and Techniques", Second Edition, Elsevier, Reprinted2008(Unit II-Unit VI)
4. Dr.CarolynK.Hamm,"Oracle Data Mining",RampantTechPress, SPD.
5. C.Ballard, Dynamic Warehousing and Data Mining Made Easy,ReddBooks,IBM (SPD),Sept 2007.
6. H.Witten and E. Frank. Data Mining: Practical Machine Learning Tools and Techniques. MorganKaufmann. 2005.
7. D. Hand, H. Mannila and P. Smyth. Principles of Data Mining. Prentice-Hall. 2001.
8. Z.Tang and J MacLennan, "Data Mining with SQL Server 2005",Wiley

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP201	**PRACTICAL OF RPSITP201 (DATA MINING)**	**2**	**2**
	1. Design the data mining model using SQL server / Oracle. 2. Show the implementation of Naïve Bayes algorithm. 3. Show the implementation of Decision Tree. 4. Show the implementation of Time Series Algorithm. 5. Show the implementation of Clustering Algorithm. 6. Show the implementation of k-nearest neighbor. 7. Show the implementation of Apriori Algorithm 8. Show the implementation of Association Algorithm. 9. Show the implementation of Text Mining. 10. Show the implementation of Multimedia Mining. 11. 12. Show the implementation of Spatial Mining.		

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT202	**RPSIT202** **MOBILE & ENTERPRISE NETWORKS**	**4**	**4**

Course Objective:

- To explain the basic concepts in mobile computation.
- To teach mobile telecommunication basics and make students familiar with the network protocol stack.
- To expose students to wireless networks and the Ad-hoc Networks.
- To bring awareness in students about different mobile platforms and application development.

Expected Learning Outcome:

Students completing this course will be able to:

- Understand mobile networks and mobile telecommunication system.
- Identify the solutions to the problems in mobile technology.
- Develop applications using various development tools.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	Telecommunication Systems: GSM: Mobile services, System architecture, Radio interface, Protocols, Localization And Calling, Handover, Security, New data services; DECT: System architecture, Protocol architecture; TETRA, UMTS and IMT-2000: UMTS Basic architecture, UTRA Démodé, UTRA TDD mode Satellite Systems: History, Applications, Basics:GEO, LEO, MEO; Routing, Localization, Handover, Examples	12 L
II	Broadcast Systems: Overview, Cyclic repetition of data, Digital audio broadcasting: Multimedia object transfer protocol; Digital video broadcasting Wireless LAN: Infrared vs. Radio transmission, Infrastructure and Ad hoc Networks, IEEE 802.11: System architecture, Protocol architecture, Physical layer, Medium access control layer, MAC management, Future development; HIPERLAN: Protocol architecture, Physical layer, Channel access control. Sublayer, Medium access control Sublayer, Information bases And Networking; Bluetooth: User scenarios, Physical layer, MAC layer, Networking. Security, Link management.	12 L
III	Wireless ATM: Motivation for WATM, Wireless ATM working group, WATM services, Reference model: Example configurations, Generic reference model; Functions: Wireless mobile terminal side, Mobility supporting network side; Radio access layer: Requirements, BRAN; Handover: Handover reference model, Handover requirements, Types o f handover, Handover scenarios, Backward handover, Forward handover; Location management: Requirements for location management, Procedures and Entities; Addressing, Mobile quality of service, Access point control protocol. Mobile Network Layer: Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation ,Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol, Ad hoc networks: Routing, Destination sequence distance vector, Dynamic source routing, Hierarchical algorithms, Alternative metrics	12 L
IV	Mobile Transport Layer: Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP,Snooping TCP,	12 L

	Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP. Support for Mobility: File systems: Consistency, Examples; World Wide Web: Hypertext transfer protocol, Hypertext markup language, Some approaches that might help wireless access, System architectures; Wireless application protocol: Architecture, Wireless datagram protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Wireless markup language, WML script, Wireless telephony application, Examples Stacks withWap, Mobile databases, Mobile agents.	
V	Enterprise Networking Architecture Enterprise Campus Architecture and Design Introduction, Campus Architecture and Design Principles, Modularity, Campus Services, Virtualization Services, Security Services	12 L

References:

1. Johan Schiller, "Mobile communications", Addison wisely , Pearson Education ,2nd edition
2. Wiiliam Stallings, "Wireless Communications and Networks", 2nd edition
3. Rappaort, "Wireless Communications Principals and Practices" 2nd edition
4. YI Bing Lin , "Wireless and Mobile Network Architectures", John Wiley,2001.
5. P. Nicopolitidis , "Wireless Networks", John Wiley ,2003.
6. K Pahlavan, P. Krishnamurthy , "Principles of Wireless Networks" ,A unified Approach.
7. M. Richharia , "Mobile Satellite Communication: Principles and Trends", Pearson Education
8. Enterprise Campus 3.0 Architecture: Overview and Framework.

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP202	**PRACTICAL OF RPSITP202 (MOBILE & ENTERPRISE NETWORKS)**	**2**	**2**
	1. Develop UI with different controls on Mobile. 2. Using buttons, radiobuttons, checkboxes on Mobile. 3. Create a simple temperature converter application. 4. Design a simple calculator. 5. Program for simple quiz competition. 6. Program to insert and display data from. 7. Program to generate Calendar. 8. Design a simple to-do list. 9. Program to demonstrate simple Animation. 10. Developing a Android App based on some real world case study. 11. Create and demonstrate an enterprise network 12. Enable and configure security services in enterprise networking		

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT203	**RPSIT203 ARTIFICIAL INTELLIGENCE**	**4**	**4**

Course Objective:

- The traditional approach to machine learning using symbolic representations & manipulations, i.e., knowledge representations and problem-solving techniques.
- Techniques and application of machine learning techniques to robots and similar learning agents.

Expected Learning Outcome:

Students completing this course will be able to:

- be able to design a knowledge based system,
- be familiar with terminology used in this topical area,
- have read and analyzed important historical and current trends addressing artificial intelligence.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	**Introduction:** AI,Components of AI,History of AI, Salient Points, Knowledge and Knowledge Based Systems, AI in Future, Applications. **Logic and Computation:** Classical Concepts, Computational Logic, FOL, Symbol Tableau, Resolution, Unification, Predicate Calculus in Problem Solving, Model Logic, Temporal Logic. **Intelligent Agents** Agents and Environments , Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents	12 L
II	**Solving Problems by Searching** Problem-Solving Agent,Searching for Solutions,Uninformed Search Strategies, Informed (Heuristic) Search Strategies Heuristic Functions Local Search Algorithms and Optimization Problems Hill-climbing search, Simulated annealing, Local beam search,Geneticalgorithms,Local Search in Continuous Spaces, Searching with Nondeterministic Actions. Searching with Partial Observations. Online Search Agents and Unknown Environments **Automated Reasoning:** Default Logic, Problem for Default Reasoning, Closed World Assumption, Predicate Completion, Circumscription, Default Reasoning, Model Based Reasoning, Case Based Reasoning, Reasoning Models, Multimodels, Multimodal Reasoning. **[Reference I]**	12 L
III	**Games** Optimal Decisions in Games , Alpha--Beta Pruning , Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-of-the-Art Game Programs, Alternative Approaches **Constraint Satisfaction Problems** Defining Constraint Satisfaction Problem, Constraint Propagation: Inference in CSPs , Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems **Knowledge Acquisition:** Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving , Effective Propositional Model Checking, Agents Based on Propositional Logic.	12 L
IV	**First-Order Logic** Representation Revisited, Syntax and Semantics of First-Order Logic, Using First-Order Logic , Knowledge Engineering in First-Order Logic	12 L

	Inference in First-Order Logic Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution	
V	**Uncertain knowledge and reasoning** Quantifying Uncertainty , Probabilistic Reasoning Knowledge in Learning A Logical Formulation of Learning, Knowledge in Learning, Explanation-Based Learning, Learning Using Relevance Information, Inductive Logic Programming	12 L

References:

1. Artificial Intelligence: A Modern Approach, S.Russel, P.Norvig, Pearson Education, 2003
2. Artificial Intelligence, E.Rich and K.Knight, TMH, 2002.

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP203	**PRACTICAL OF RPSITP203 (ARTIFICIAL INTELLIGENCE)**	**2**	**2**
	1. Search Algorithms a. Depth First Search b. Breadth First Search c. Uniform Cost Search d. A* Search 2. Reflex Agent 3. Minimax 4. Alpha-Beta Pruning 5. Perceptron Analysis 6. Corners Problem: a. Representation b. Heuristic 7. Demonstrate inductive logic 8. Demonstrate the following a. Unification b. First order inference c. Forward chaining d. Backward chaining		

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT204	**RPSIT204** **VIRTUALIZATION & CLOUD COMPUTING**	**4**	**4**

Course Objective:

- To introduce broad perspective of cloud architecture and models.
- To discuss the fundamentals of cloud computing and virtualization.
- To make students aware of the lead players of cloud.
- To discus & make students aware of various security issues in cloud computing.
- To demonstrate various tools & software used in implementation of cloud.

- To demonstrate and use various technologies used in the development of various cloud based services.

Expected Learning Outcome:

Students completing this course will be able to:

- Describe and compare distributed systems, grid, clusters systems used for computation.
- Understand the fundamentals of virtualization and cloud computing.
- Use various tools and software used to configure the cloud while implementation.
- Understand various programming paradigms used in the development of cloud services.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	Distributed System Models and Enabling Technologies • Scalable Computing Service over the Internet • Technologies for Network-Based Systems. • System Models for Distributed and Cloud Computing • Software Environments for Distributed Systems and Clouds: • Performance, Security and Energy Efficiency Computer Clusters for scalable parallel computing: • Clustering for massive parallelism	12 L
II	Virtual machines and Virtualization of clusters and Data centers • Implementation levels of virtualization • Virtualization Structures/Tools and Mechanisms • Virtualization of CPU, Memory & I/O Devices • Virtual Cluster Resource Management • Virtualization for Data Center Automation	12 L
III	Cloud Platform Architecture over Virtualized Data Centers • Cloud Computing & Service Models • Data Center Design and Interconnection Networks • Architectural Design of Compute and Storage Clouds. • Public Cloud Platforms: GAE, AWS and AZURE • Inter-cloud Resource Management. • Cloud Security and Trust Management.	
IV	Cloud Programming and Software Environments • Features of Cloud and Grid Platforms • Parallel and Distributed Programming Paradigms. • Programming Support of Google App Engine. • Programming on Amazon AWS and Microsoft Azure. • Emerging Cloud Software Environments.	12 L
V	Service-Oriented Architecture for Distributed Computing • Services and Services-Oriented Architecture. • Message-Oriented Middleware • Portals and Science Gateways. • Discovery, Registeries, Metadata & Databases • Workflow in Service-Oriented Architectures.	12 L

References:

1. Kai Hwang, Jack Dongarra, Geoffrey Fox: Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, MK Publishers, 2012.

2. Michael Miller, Cloud Computing: Web-Based Applications that change the Way you work and collaborate Online, Pearson Publication, 2012.
3. John Krumm, Ubiquitous Computing Fundamentals, CRC Press,2010.
4. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter: Cloud Computing, A Practical Approach, McGraw Fill, 2010.

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP204	**PRACTICAL OF RPSITP204 (VT & CC)**	**2**	**2**
	1. Create virtual networks of windows 7 systems using VMWare Technologies. 2. Create a Windows based client-server system using Windows 2012 Hyper-V. 3. Create a Linux based client-server system using Citrix Xen Server 4. Implement server clusters using Windows 2012 Hyper-V. 5. Working with a Cloud Management Software(OpenNebula/Eucalyptus) 6. Create a small website application using Google App Engine 7. Create a small website application using Windows Azure 8. Implement MapReduce and Hadoop 9. Using cloud database for storage. (Google/AWS etc)		

SEMESTER III - THEORY

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT301	**RPSIT301 EMBEDDED SYSTEMS**	**4**	**4**

Course Objective:

- To introduce students to the modern embedded systems and to show how to understand and program such systems using a concrete platform built around
- A modern embedded processor like the Intel ATOM.

Expected Learning Outcome:

Students completing this course will be able to:

- Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems..
- Become aware of the architecture of the ATOM processor and its programming aspects (assembly Level)
- Become aware of interrupts, hyper threading and software optimization.
- Design real time embedded systems using the concepts of RTOS.
- Analyze various examples of embedded systems based on ATOM processor.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	**Introduction** What is an Embedded System, Embedded System Vs, General Computing System. **The Typical Embedded System** Core of Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware. **Characteristic and quality attributes of Embedded System** Characteristics of an Embedded System, Quality Attributes of Embedded System.	12 L
II	**Memories and Memory Subsystem** Introduction, Classifying Memory, A general Memory Interface, ROM Overview, Static RAM Overview, Dynamic RAM Overview, Chip Organization, A SRAM Design, A DRAM Design, The DRAM Memory Interface, The Memory Map, Memory Subsystem Architecture, Basic Concepts of Caching, Design a cache system, Dynamic Memory Allocation, Testing Memories.	12 L
III	**Hardware Software Co-design and Program Modeling** Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language (UML), Hardware Software Trade-offs. **Embedded Hardware design and development** Analog Electronic Components, Digital Electronic Components, Electronic design Automation (EDA) Tools, The PCB Layout design. **Embedded Firmware design and development** Embedded Firmware Design Approaches, Embedded Firmware Development Languages **Real Time Operating System(RTOS)**	12 L

	Operating System Basics, Types of Operating Systems, Device Drivers, How to choose an RTOS **Embedded product development life cycle** What is EDLC, Why EDLC? Objectives of EDLC, Different Phases of EDLC**.**	
IV	**Programming Concept and Embedded Programming in C/C++ and Java** Software programming in Assembly Language (ALP) and in High-level Language 'C'., C program Elements: Header and Source Files and Pre-processor Directives, Program Elements: Macros and Functions, Program Elements: Types, Data Structures, Modifiers, Statements, Loops and Pointers, Object-Oriented Programming, Embedded Programming in C++, Embedded Programming in Java**.**	12 L
V	**Trends in the Embedded Industry** Processor trends in Embedded System, Embedded OS Trends, Development Language Trends, Introduction of PIC Family of Microcontrollers, Introduction of ARM Family of Microcontrollers, Introduction of AVR Family of Microcontrollers**.**	12 L

References:

1. Introduction to embedded systems Shibu K. V 2nd Edition Tata McGraw-Hill
2. Embedded Systems Architecture, Programming and Design Raj Kamal 2nd Edition Tata McGraw-Hill
3. Embedded Systems: A Contemporary Design Tool. James K. Peckol 1st Edition Wiley Edition

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP301	**PRACTICAL OF RPSITP301 (EMBEDDED SYSTEMS)**	**2**	**2**
	1. Design a elevator simulator 2. Design a traffic signal simulator 3. Design a calculator 4. Convert a Digital Signal to Analog and vice versa 5. Develop an application to demonstrate serial communication between to devices 6. Develop an application to demonstrate parallel communication between to devices 7. Develop an application to demonstrate working with memory module. 8. Design a simple game.		

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT302	**RPSIT302** **BIG DATA ANALYTICS**	**4**	**4**

Course Objective:

- To provide foundation level training that enables immediate and effective participation in big data projects.

- To provide basic and advanced methods to big data technology and tools, including MapReduce and Hadoop and its ecosystem.

Expected Learning Outcome:

Students completing this course will be able to:

- Use the trick for Big Data use cases and solutions.
- Learn to build and maintain reliable, scalable, distributed systems with Apache Hadoop.
- Apply Hadoop ecosystem components.
- Understand the requirements for Data Analysis.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	**INTRODUCTION TO BIG DATA** **Big Data - From the Business Perspective:** Characteristics of Big Data, The 5 Vs of Data, Data in the Warehouse and Data in Hadoop, Importance of Big Data, When to Consider a Big Data Solution **Big Data Use Cases:** Patterns for Big Data Deployment, IT for IT Log Analytics, The Fraud Detection Pattern, The Social Media Pattern, The Call Centers, Risk: Patterns for Modeling and Management, Big Data and the Energy Sector	12 L
II	**BIG DATA ANALYTICS FUNDAMENTALS** **Introduction to Big Data Analytics:** Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics **Data Analytics Life Cycle:** Data Analytics Lifecycle Overview, Discovery, Preparation, Model Planning, Model Building, Communicate Results, Operationalize, Case Study: Global Innovation Network and Analysis (GINA).	12 L
III	**ADVANCE ANALYTICAL METHODS** **Advanced Analytical Theory and Methods-Time Series Analysis:** Overview of Time Series Analysis, ARIMA Model, Additional Methods. **Advanced Analytical Theory and Methods-Text Analysis:** Text Analysis Steps, Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency-Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments, Gaining Insight. **Shingling of Documents:** Finding Similar Items, Applications of Near-Neighbor Search, Jaccard similarity of sets, Similarity of documents, Collaborative filtering as a similar-sets problem, Documents, k-Shingles, Choosing the Shingle Size, Hashing Shingles, Shingles built from Words. Similarity-Preserving Summaries of Sets, Locality-Sensitive hashing for documents. The Theory of Locality-Sensitive functions. Methods for high degrees of similarity	12 L
IV	**INTRODUCTION TO MAP REDUCE** The map tasks, Grouping by key, The reduce tasks, Combiners, Details of MapReduce Execution, Coping with node failures. **Algorithms Using MapReduce:** Matrix-Vector Multiplication, Computing Selections and Projections, Union, Intersection, and Difference, Natural Join. Extensions to MapReduce: Workflow Systems, Recursive extensions to MapReduce.	
V	**BIG DATA TECHNOLOGIES** **Fundamentals of Hadoop:** Data, Data Storage and Analysis, Querying All Data, Comparison with Other Systems. **The Hadoop Distributed File System:** The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop Filesystems, The Java Interface, Data Flow.	

	Integrating R and Hadoop: Architecture, Samples and function reference of RHIPE and RHADOOP, Data Analytics Problems: Exploring web pages categorization, Computing the frequency of stock market Change, Predicting the sale price of blue book for bulldozers – case study.	

References:

1. Understanding Big data , Chris Eaton, Dirk deroos et al. , McGraw Hill, 2012.
2. Hadoop The Definitive Guide, Tom White, O'Reilly,3rd edition.
3. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services,2015.
4. Big Data Analytics with R and Hadoop, Vignesh Prajapati, PACKT Publishing,2013.
5. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012.

Additional References:

1. Professional Hadoop Solutions, Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, WROX
2. http://www.bigdatauniversity.com/
3. EMC Material/Courseware: https://education.etnc.com/

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP302	**PRACTICAL OF RPSITP302(BIG DATA ANALYTICS)**	**2**	**2**
	1. Generate time series model and interpret the result for a given data set. 2. Categorize documents by topics 3. Perform sentiment analysis on twitter. 4. Write a program for measuring similarity among documents and detecting passages which have been reused 5. Write a program to construct different types of k-shingles for given document. 6. Write a map reduce program to find out what are the top 5 categories with maximum number of videos uploaded on youtube 7. Write a map reduce program to find the top 10 rated videos on youtube 8. Write a map reduce program to analyse image and video. 9. Write a map-reduce program: (i) to find matrix-vector multiplication; (ii) to compute selections and projections; 10. (iii) to find union, intersection, difference, natural Join for a given dataset. 11. Write a mapreduce program to find Find highest temperature for each year in weather data set		

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT303A	**RPSIT303A ETHICAL HACKING**	**4**	**4**

Course Objective:

This course teaches students the underlying principles and many of the techniques associated with the cyber security practice known as penetration testing or ethical hacking. Students will learn about the entire penetration testing process including planning, reconnaissance, scanning, exploitation, post-exploitation, and result reporting. The course will provide the fundamental information associated with each of the methods employed and insecurities identified. In all cases, remedial techniques will be explored. Students will develop an excellent understanding of current cyber security issues and ways that user, administrator, and programmer errors can lead to exploitable insecurities.

Expected Learning Outcome:

Students completing this course will be able to:

- Understand the core concepts related to computer software and hardware.
- Understand the various ways to find the vulnerabilities and solutions to them.
- Understand the legal issues and IT Laws laid down in the Cyber Security.
- Exploit and find the vulnerabilities using various tools.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	Introduction to Ethical Hacking, Footprinting and Reconnaissance - Social Engineering,, Scanning Networks, Enumeration	12 L
II	System Hacking, Trojans and Backdoors, Viruses and Worms, Sniffing, Denial of Service,	12 L
III	Hacking Webservers& Web Applications, Session Hijacking, SQL Injection	12 L
IV	Hacking Wireless Networks, Hacking Mobile Platforms, Evading IDS, Firewalls, Buffer Overflows, Cryptography, Penetration Testing	12 L
V	Cyber Laws& IT Act Understanding Computers, Internet & Cyber Laws, Conceptual Framework of E-Commerce, Cyber crime and criminal justice, Patents & Copyright, Introduction to IPR.	12 L

References:

1. Ethical Hacking Review Guide, Kimberly Graves, Wiley Publishing
2. Ethical Hacking Ankit Fadia, 2nd Edition, Macmillan India Ltd, 2006
3. Insider Computer Fraud, Kenneth C.Brancik, 2008,Auerbach Publications Taylor & Francis Group
4. Cyber Law Simplified, Vivek Sood, TMH
5. Cyber Laws and IT Protection, Harish Chander, PHI Learning,2012

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP303A	**PRACTICAL OF RPSITP303A (ETHICAL HACKING)**	**2**	**2**
	1. Using Footprinting, Reconnaissance & Social Engineering tools 2. Using Network Scanning & Enumeration tools 3. Using System Hacking tools 4. Using Trojans, Backdoors, Viruses & Worms tools 5. Using tools for sniffing		

	6. Using tools for Web Hacking (webservers, session hijacking, sql injections) 7. Using tools for wireless hacking 8. Using tools for evading IDS, Firewalls 9. Using Cryptanalysis.		

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT303B	**RPSIT303B ARTIFICIAL NEURAL NETWORKS**	**4**	**4**

Course Objective:

- to introduce the neural networks for classification and regression
- to give design methodologies for artificial neural networks
- to provide knowledge for network tunning and overfitting avoidance
- to offer neural network implementations in Matlab
- to demonstrate neural network applications on real-world tasks.

Expected Learning Outcome:

Students completing this course will be able to:

- understand the differences between networks for supervised and unsupervised learning
- design single and multi-layer feed-forward neural networks
- develop and train radial-basis function networks
- program linear and nonlinear models for data mining
- analyse the performance of neural networks.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	The Brain Metaphor, Basics of Neuroscience, Artificial Neurons, Neural Networks and Architectures	12 L
II	Geometry of Binary Threshold Neurons and Their Networks , Supervised Learning I: Perceptrons and LMS, Supervised Learning II: Backpropagation and Beyond	12 L
III	Neural Networks: A Statistical Pattern Recognition Perspective , Statistical Learning Theory, Support Vector Machines and Radial Basis Function Networks	12 L
IV	Dynamical Systems Review, Attractor Neural Networks, Adaptive Resonance Theory	12 L
V	Towards the Self-organizing Feature Map, Fuzzy Sets and Fuzzy Systems , Evolutionary Algorithms	12 L

References:

1. Neural Networks, A Classroom Approach, Satish Kumar, 2nd Edition, McGraw Hill
2. Artificial Neural Networks, Robert Schalkoff, McGraw Hill
3. Introduction to Neural Networks using MATLAB, S Sivanandam, SSumathi, McGraw Hill

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP303 B	**PRACTICAL OF RPSITP303B (ARTIFICIAL NEURAL NETWORKS)**	**2**	**2**
	At least 8 practicals based on above syllabus must be covered.		

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT304A	**RPSIT304A DIGITAL FORENSICS**	**4**	**4**

Course Objective:

The course focuses on the procedures for identification, preservation, and extraction of electronic evidence, auditing and investigation of network and preparation of expert testimonial evidence.

Expected Learning Outcome:

Students completing this course will be able to:

- Identify the type of crime committed in the cyber space.
- Initiate and investigate any cyber related crime.
- Draw conclusions based on the investigation in the cyber/digital space.
- Use various tools for investigating a real time case in the cyber space.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	Computer Forensics and Investigation Processes,Understanding Computing Investigations,The Investigator's Office and Laboratory, Data Acquisitions.	12 L
II	Processing Crime and Incident Scenes,Working with Windows and DOS Systems, Current Computer Forensics Tools.	12 L
III	Macintosh and Linux Boot Processes and File Systems,Computer Forensics Analysis,Recovering Graphics Files.	12 L
IV	Virtual Machines, Network Forensics, and Live Acquisitions, E-mail Investigations, Cell Phone and Mobile Device Forensics	12 L
V	Report Writing for High-Tech Investigations,Expert Testimony in High-Tech Investigations,Ethics and High-Tech Investigations.	12 L

References:

1. Guide to Computer Forensics and Investigations Bell Nelson, Amelia Phillips,Christopher Steuart, 4th Edition, Cengage Learning
2. Computer Forensics A Pocket Guide, Nathan Clarke, I.T G.vernance Publishing
3. Computer Forensics: Computer Crime Scene Investigation, John R. Vacca, 2nd Edition, Charles River Media.

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP304A	**PRACTICAL OF RPSITP304A (DIGITAL FORENSICS)**	**2**	**2**
	1. File System Analysis using The Sleuth Kit 2. Using Windows forensics tools 3. Using Data acquisition tools 4. Using file recovery tools 5. Using Forensic Toolkit (FTK) 6. Forensic Investigation using EnCase 7. Using Steganography tools 8. Using Password Cracking tools 9. Using Log Capturing and Analysis tools 10. Using Traffic capturing and Analysis tools 11. Using Wireless forensics tools 12. Using Web attack detection tools 13. Using Email forensics tools 14. Using Mobile Forensics software tools 15. Writing report using FTK		

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT304B	**RPSIT304B MACHINE LEARNING**	**4**	**4**

Course Objective:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To develop skills of using recent machine learning software for solving practical problems.
- To gain experience of doing independent study and research.

Expected Learning Outcome:

Students completing this course will be able to:

- Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
- Have an understanding of the strengths and weaknesses of many popular machine learning approaches.
- Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
- Be able to design and implement various machine learning algorithms in a range of real-world applications.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	Introduction : Well-posed Learning Problems, Designing a learning system, Perspective and Issues in Machine Learning. Concept Learning and the General-to-Specific Ordering: A Concept learning task, Concept learning as search, Find-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate-Elimiation, Candidate elimination learning Algorithm.	12 L

II	Decision Tree Learning: Decision tree Representation, Appropriate Problems for decision tree learning, The basic decision tree learning Algorithm, Hypothesis spaces search in decision tree learning, Inductive Bias in Decision tree learning, Issues in Decision tree learning. Artificial Neural Network: Neural Network Representations, Appropriate problems for Neural Network learning, Perceptorns. Multilayer Neural Network and the Back propagation algorithm.	12 L
III	Bayesian Learning : Bayes theorem and concept learning, Maximum likelihood and least square error hypothesis, Maximum Likelihood hypothesis for predicting probabilities, Minimum description lenght principle, Bayes optimal classifier. Gibbs algorithm, Naive Bayes classifier. Bayes Belief Network.The EM Algorithm. Instance Based Learning: K-Nearest Neighbor learning, Locally Weighted Regression, Radial Basis Function, Case-based Reasoning. Learning Sets of Rules: Sequential Covering Algorithms, Learning Rule sets, learning First Order Rules, Induction as inverted deduction, Inverting Resolution.	12 L
IV	Genetic Algorithms: Introduction to Genetic Algorithms, Hypothesis space search, Genetic programming, Models of evolution and learning, parallelizing genetic algorithms. Analytical Learning: Learning with Perfect domain theories: Prolog-EBG, Explanation-based learning of search control knowledge.	12 L
V	Combining inductive and analytical learning: Inductive-analytical approaches to learning, using prior knowledge to initailize the hypothesis, Using prior knowledge to alter the search objective, Using prior knowledge to Augment Search Operators Reinforcement learning: The learning task, Q learning, Non-Deterministic Rewards and actions, Temporal Difference learning, Generalizing from examples, Relationship to dynamic programming	12 L

Text book:

- Machine Learning, Tom Mitchell, McGraw Hill, 1997.
- Introduction to machine learningNils J. Nilsson,1997.

Reference:

- David Barber's Bayesian Reasoning and Machine Learning
- Kevin Murphy's Machine learning: a Probabilistic Perspective
- Hastie, Tibshirani, and Friedman's The Elements of Statistical Learning
- Bishop's Pattern Recognition and Machine Learning
- Mitchell's Machine Learning

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP304B	**PRACTICAL OF RPSITP304B (MACHINE LEARNING)**	**2**	**2**
	1. Implement decision tree algorithm 2. Implement back propagation algorithms for a multi layer neural network 3. Implement Gibbs algorithm 4. Implement Baye's belief network 5. Implement Naive Bayes classifier. 6. Implement EM algorithm 7. Implement k nearest neighbor algorithm 8. Implement radial basis function network 9. Implement Q learning		

SEMESTER IV - THEORY

COURSE CODE	COURSE NAME	CREDITS	LECTURE /WEEK
RPSIT401	**RPSIT401** **INFORMATION SECURITY MANAGEMENT**	**4**	**4**

Course Objective:

In this course students learn basics of information security, in both management aspect and technical aspect. Students understand of various types of security incidents and attacks, and learn methods to prevent, detect and react incidents and attacks. Students will also learn basics of application of cryptography which are one of the key technology to implement security functions.

Expected Learning Outcome:

Students completing this course will be able to:

- have an understanding of the key themes and principles of information security management and be able to apply these principles in designing solutions to managing security risks effectively;
- understand how to apply the principles of information security management in a variety of contexts;
- have an appreciation of the interrelationship between the various elements of information security management and its role in protecting organisations.

UNITS	COURSE CONTENTS	NO. OF LECTURES
I	Security Risk Assessment and Management: Introduction to Security Risk Management. Reactive and proactive approaches to risk management. Risk assessment, quantitative and qualitative approaches and asset classification - Security Assurance Approaches: Introduction to OCTAVE and COBIT approaches.	12 L
II	Security Management of IT Systems: Network security management. Firewalls, IDS and IPS configuration management. Web and wireless security management. General server configuration guidelines and maintenance. Information Security Management Information classification. Access control models, role-based and lattice models. Mandatory and discretionary access controls. Linux and Windows case studies. Technical controls, for authentication and confidentiality. Password management and key management for users. Case study: Kerberos.	12 L
III	Key Management in Organizations: Public-key Infrastructure. PKI Applications, secure email case study(S/ MIME or PGP). Issues in public-key certificate issue and lifecycle management - Management of IT Security Infrastructure; Computer security log management, malware handling and vulnerability management programs. Specifying and enforcing security policies.	12 L
IV	Auditing and Business continuity Planning: Introduction to information security audit and principles of audit. Business continuity planning and disaster recovery. Case study: 9/11 tragedy. Backup and recovery techniques for applications and storage	12 L
V	Computer forensics: techniques and tools. Audit Tools: NESSUS and NMAP. Information Security Standards and Compliance: Overview of ISO 17799 Standard. Legal and Ethical issues	12 L

References:

1. IT Security and Risk Management(Main reference) Slay, J. and Koronios, A.,2006 Wiley
2. Incident Response and Computer Forensics. Chris Prosise and Kevin Mandia,2003. McGraw-Hill

3. Information Systems Security-Security Management, Metrics, Frameworks and Best Practices, Nina Godbole, Wiley, 2009
4. Information Security Policies, Procedures, and Standards: Guidelines for Effective Information Security Management (Paperback), 1st edition, Auerbach, 2001.

COURSE CODE	COURSE NAME	CREDITS	LECTURE/ WEEK
RPSITP401	**PRACTICAL OF RPSITP401 (INFORMATION SECURITY MANAGEMENT)**	**2**	**2**
	1. Working with Sniffers for monitoring network communication (Ethereal) 2. Using open SSL for web server - browser communication 3. Using GNU PGP 4. Performance evaluation of various cryptographic algorithms 5. Using IP TABLES on Linux and setting the filtering rules 6. Configuring S/MIME for e-mail communication 7. Understanding the buffer overflow and format string attacks 8. Using NMAP for ports monitoring 9. Implementation of proxy based security protocols in C or C++ with features like confidentiality, integrity and authentication 10. Socket programming 11. Exposure to Client Server concept using TCP/IP, blowfish, Pretty Good Privacy.		

COURSE CODE	COURSE NAME	CREDITS
RPSIT402	**RPSIT402 PROJECT**	**4**

Course Objective:

- To make students use their knowledge in solving real world problems.
- To encourage students to take up some research based project.
- To encourage students to use the tools/technologies they learn for implementing their ideas.

The syllabus proposes project implementation as part of the semester–IV. The student is expected to give a presentation of the project proposed and get verified and sanctioned by the project guide. In addition, experimental set up, analysis of results, comparison with results of related works, conclusion and future prospects will be part of the project implementation. A student is expected to make a project implementation report and appear for a project viva. He or she needs to spend around 200-250 hours on the project implementation for which the student will be awarder 6 credits.

COURSE CODE	COURSE NAME	CREDITS
RPSIT403	**RPSIT403** **INTERNSHIP (Approx 200-300 hrs)**	**14**

Course Objective:

- To introduce students to the work environment of industry.
- To gain and acquire the knowledge pertaining to real world problems.

The syllabus proposes an internship for about 200-300 hours to be done by a student. It is expected that a student chooses an IT or IT-related industry and formally works as a full time intern during the period. The student should give a presentation of the internship subject as the part of internship evaluation with proper documentation of the attendance and the type of work he or she has done in the chosen organization. Proper certification (as per the guidelines given) by the person, to whom the student was reporting, with Organization's seal should be attached as part of the documentation. Student will be awarded 14 credits for the entire internship along with the final presentation in front of the examiners.

M.Sc. EVALUATION SCHEME

THEORY (100 Marks)

Internal Exam-40 Marks

i. **20 Marks Test:**

It will be conducted either using any open source learning management system such as Moodle (Modular object-oriented dynamic learning environment)

ii. **20 Marks-**

Develop project in group (maximum five students) and presentation.

Or

Tutorial of around 10 problems to be solved in class

Or

Quizzes consisting of at least 20 questions based on current trends.

Or

MOOC Courses.

Theory Question Paper Pattern (INFORMATION TECHNOLOGY):-

All Questions are Compulsory		
Questions	**Based On**	**Marks**
Q.1	Unit I	12
Q.2	Unit II	12
Q.3	Unit III	12
Q.4	Unit IV	12
Q.5	Unit V	12

All questions shall be compulsory with internal choice within the questions.

- Each Question will have 4 sub-questions carrying 6 marks each, out of which student has to answer only 2.

PRACTICAL (50 Marks)

Internal Practical - 20 Marks

10 Marks - Individual Practical Implementation & Performance

- Each student will maintain an e-journal. After every practical students will upload his practicals in the form of documents along with the screen shots of output on online portal (Moodle/Google site/any LMS).
- Students should show their regular practical completion chart duly signed by faculty with dates.

10 Marks –Design and implement innovative application of the technology

External Practical Component - 30 Marks

30 Marks Practical Question -

- Student has to acquire at least 40% marks in each paper individually.

PROJECT (100 Marks)

INTERNAL COMPONENT - 40 Marks

- Abstract submission & literature Survey / sample data collection - 10 Marks
- Technology Implementation - 10 marks
- Mid-Term Presentation - 10 Marks
- Project Documentation- 10 marks

EXTERNAL COMPONENT - 60 Marks

- Project Quality - 20 Marks.
- Project Implementation - 20 Marks.
- Presentation - 20 Marks.

INTERNSHIP (350 Marks)

INTERNAL COMPONENT - 140 Marks

Assessment will be done by the Employer and Internship Coordinator jointly. Following are the guidelines:

- Job description
- Technical knowledge/skills
- Open to new ideas and learning new techniques
- Innovativeness & creativity
- Adherence to Schedule (weekly activity report)
- Soft Skills (Communication, Individual & Team work, Resource Management, Leadership qualities)
- Discipline & behavior

EXTERNAL COMPONENT - (210) Marks

Based on the detailed work report duly signed by the employer and the internal faculty. A presentation is expected from the student for sharing his/ her learning experience and work done at the internship.

- Internship Report
- Suitability & Clarity of material presented
- Quality of oral presentation

PASSING CRITERIA 40%: - Student has to acquire minimum of 40% marks each course (Theory/Practical/Project) both.