SEMESTER VII

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	HS	BA20151	Entrepreneurship Development	3	0	0	3
2	PC	CY20701	Machine Learning	3	0	0	3
3	PE	CY2035*	Professional Elective III	3	0	0	3
4	PE	CY2045*	Professional Elective IV	3	0	0	3
5	OE	CY2090*	Open Elective II	3	0	0	3
Practical							
7	PC	CY20702	Machine Learning Laboratory	0	0	2	1
8	EE	CY20703	Mini Project Work	0	0	6	3
			Total	**15**	**0**	**10**	**19**

SEMESTER VIII

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	CY20801	Malware Analysis	3	0	0	3
2	PE	CY2055*	Professional Elective V	3	0	0	3
3	PE	CY2065*	Professional Elective VI	3	0	0	3
Practical							
4	EE	CY20802	Project Work	0	0	12	6
			Total	**9**	**0**	**12**	**15**
							Total Credits: 164

PROFESSIONAL ELECTIVE COURSES (PE III)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	CY20351	Security Governance, Risk and Compliance	3	0	0	3
2.	PE	CY20352	Cloud Computing	3	0	0	3
3.	PE	CY20353	Big Data Analytics	3	0	0	3
4.	PE	CY20354	Software Testing	3	0	0	3
			TOTAL	**12**	**0**	**0**	**12**

PROFESSIONAL ELECTIVE COURSES (PE IV)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	CY20451	Security Audit and Risk Assessment	3	0	0	3
2.	PE	CY20452	Secure Software Development Life Cycle	3	0	0	3
3.	PE	CY20453	Information Visualization	3	0	0	3
4.	PE	CY20454	Android Security	3	0	0	3
			TOTAL	**12**	**0**	**0**	**12**

PROFESSIONAL ELECTIVE COURSES (PE V)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	CY20551	Secure Software Design	3	0	0	3
2.	PE	CY20552	Reverse Engineering	3	0	0	3
3.	PE	CY20553	Biometrics and Security	3	0	0	3
4.	PE	CY20554	Block chain Technology	3	0	0	3
			TOTAL	**12**	**0**	**0**	**12**

PROFESSIONAL ELECTIVE COURSES (PE VI)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	CY20651	Criminal Psychology	3	0	0	3
2.	PE	CY20652	Software Project Management	3	0	0	3
3.	PE	CY20653	Social Network Analysis	3	0	0	3
4.	PE	CY20654	Cloud Security	3	0	0	3
			TOTAL	**12**	**0**	**0**	**12**

OPEN ELECTIVE COURSES (OE II)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	OE	CY20903	Free and Open Source Software	3	0	0	3
2.	OE	CY20904	Cyber Security Essentials	3	0	0	3
			TOTAL	**6**	**0**	**0**	**6**

BA20151 **ENTREPRENEURSHIP DEVELOPMENT** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- understand the Management principles.
- build the entrepreneurial competencies & analyse the support rendered by government and other agencies in entrepreneurship development.
- understand the business opportunities & to prepare a Feasibility Report.
- propose a business plan.
- appraise & comprehend the various factors to be considered for launching a small business.

UNIT I BASICS OF MANAGEMENT **9**

Management: Meaning, Definition, Nature and Importance; Roles of management - Functions of Management - Levels of Management - Functional areas of Management: Marketing, Finance, Production, HRM, IT, R & D.

The Evolution & Development of Management Thought : Classical, Neo -classical, System and Contingency Approaches - An Overview.

UNIT II ENTREPRENEURIAL COMPETENCE & ENVIRONMENT **9**

Entrepreneurial Competence: Entrepreneurship – Definition, Role and expectations – Entrepreneurial styles and types – Characteristics of the Entrepreneur - Entrepreneurial Competencies – Functions of an Entrepreneur.

Entrepreneurial Environment: Role of Socio-Cultural, Economic and Political Environment – Institutional Support for small entrepreneurs, Assistance Programme for Small Scale Units – Institutional Framework, Central and State Government Industrial Policies and Regulations.

UNIT III ENTREPRENEURIAL DEVELOPMENT **9**

Ownership Structures – Proprietorship, Partnership, Company, Co-operative, Franchise.

Identification of Business Opportunity – Preparation of Feasibility Report – Financial and Technical Evaluation – Project Formulation – Common Errors in Project Formulation – Specimen Project Report.

Entrepreneurial Development Programs — Role of SSI Sector in the Economy – IAS Units – Failure, Causes and Preventive Measures – Turnaround Strategies.

UNIT IV BUSINESS PLAN PREPARATION, FINANCING VENTURES **9**

Business Plan: Business opportunities-SWOT, Business plan process, Feasibility Study, Functional plan-Marketing plan, Operational plan, Organizational plan, financial plan, Evaluation Criteria.

Financing ventures: sources of raising capital, seed funding, venture capital funding, funding opportunities for startups in India.

UNIT V WOMEN ENTREPRENEURSHIP AND ENTREPRENEURSHIP IN VARIOUS SECTORS 9

Women Entrepreneurship: Growth of women Entrepreneurship – Problems faced by Women Entrepreneurs – Development of women Entrepreneurship.

Entrepreneurship in Informal Sector: Rural Entrepreneurship – Entrepreneurship in Sectors like Agriculture, Tourism, Health care, Transport and allied services.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- implement the necessary managerial skills to become an entrepreneur.
- take up self-employment having been exposed to entrepreneurial environment.
- select a best business idea by using appropriate methods to assess its viability.
- formulate a business plan & deploy the resources for sustainable growth.
- analyse channels and means of launching a small business in any sector.

TEXT BOOKS

1. Khanka S.S, "Entrepreneurial Development", S. Chand & Company Limited, New Delhi, 2016.
2. Saravanavel. P, "Entrepreneurial Development", Ess Pee Kay Publishing House, Chennai, 2013.

REFERENCES

1. Donald L. Sexton & Raymond W.Smilor, "The Art and Science of Entrepreneurship", Ballinger Publishing Company, 2008.
2. Clifford M.Baumback & Joseph R.Mancuso, "Entrepreneurship and Venture Management", Prentice Hall, 1975.
3. Gifford Pinchot, "Intrapreneuring" Harper & Row Publishers, New York, 2005.
4. Mathew Manimala, "Entrepreneurship Theory at the Crossroads", Paradigms & Praxis, Biztrantra, 2nd Edition, 2015.
5. Prasanna Chandra, "Projects – Planning, Analysis, Selection, Implementation and Reviews", Tata McGraw-Hill, 2013.
6. P.C.Jain, "Handbook for New Entrepreneurs", EDII, Oxford University Press, New Delhi, 2012.

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	3	1	-	2	2	2	-	2	3	2	3
CO2	-	2	2	-	2	1	-	-	-	-	1	1	1	3
CO3	-	1	1	-	1	1	1	-	1	1	1	3	-	3
CO4	1	1	-	-	-	-	1	-	3	1	1	3	1	2
CO5	1	1	1	-	1	1	1	-	2	1	-	3	-	1

CO PO MAPPING:

CY20701 MACHINE LEARNING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn the concepts of machine learning and aspects of computational learning theory.
- gain supervised learning and their applications.
- gain unsupervised learning and their applications.
- study the theoretical and practical aspects of probabilistic graphical models.
- learn and analysis the advanced learning.

UNIT I BASICS OF MACHINE LEARNING 9

Machine Learning – Machine Learning Foundations – Overview – Design of a Learning System – Types of Machine learning – Applications Mathematical foundations of Machine Learning –Random Variables and Probabilities – Probability Theory – Probability Distributions – Decision Theory – Bayes Decision Theory – Information Theory.

UNIT II SUPERVISED LEARNING 9

Linear Models for Regression – Linear Models for Classification – Naive Bayes – Discriminant Functions – Probabilistic Generative Models – Probabilistic Discriminative Models – Bayesian Logistic Regression – Decision Trees – Classification Trees – Regression Trees – Pruning – Neural Networks – Feed Forward Network Functions – Back-Propagation – Support vector machines – Ensemble methods – Bagging – Boosting.

UNIT III UNSUPERVISED LEARNING 9

Clustering – K means – EM Algorithm – Mixtures of Gaussians–Curse of Dimensionality – Dimensionality Reduction – Factor Analysis – Principal Component Analysis – Probabilistic PCA.

UNIT IV PROBABILISTIC GRAPHICAL MODELS 9

Graphical Models – Undirected Graphical Models – Markov Random Fields – Directed GraphicalModels – Bayesian Networks – Conditional Independence Properties – Inference – Generalization – Hidden Markov Models.

UNIT V ADVANCED LEARNING 9

Sampling – Basic Sampling methods – Monte Carlo. Reinforcement Learning – K - Armed Bandit – Elements – Model - Based Learning – Value Iteration – Policy Iteration –Temporal Difference Learning – Exploration Strategies.

TOTAL PERIODS 45

TEXTBOOKS

1. Stephen Marsland, "Machine Learning of an Algorithmic Perspective", Second Edition, 2015.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.

REFERENCE BOOKS

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition, 2011.
3. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	2	-	2	1	1	2	3	2
CO2	2	2	1	1	1	1	-	-	-	1	1	1	3	2
CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

CY20702 MACHINE LEARNING LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- implementation procedures for the machine learning algorithms.
- learn the Java/Python programs for various Learning algorithms
- appropriate data sets to the Machine Learning algorithms.
- apply Machine Learning algorithms to solve real world problems.

1. Implement and demonstrate the FIND-S-algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

TOTAL PERIODS 30

COURSE OUTCOMES

At the end this course, students will be able to

- understand the implementation procedures for the machine learning algorithms.
- design Java/Python programs for various Learning algorithms.
- apply appropriate data sets to the Machine Learning algorithms.
- identify and apply Machine Learning algorithms to solve real world problems.

CO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	3	-	-	-	-	-	-	-
CO2	3	3	2	1	1	2	3	2	1	2	2	1	1	1
CO3	3	3	2	2	1	2	3	3	1	-	1	2	1	2
CO4	3	3	3	3	2	1	3	3	1	-	1	2	1	3

CY20703 MINI PROJECT WORK 0 0 6 3

COURSE OBJECTIVES

To enable students to

- recognize the significance of proper scope and the problems
- understand the strategic plans, project prioritization methods and projects
- understand the importance of scheduling / allocating resources to a project
- understand the importance of project management as it effects strategy and business success

GUIDELINES

1. The students are expected to get formed into a team of convenient groups of not more than 3 members on a project.
2. Every project team shall have a guide who is the member of the faculty of the institution. Identification of student group and their faculty guide has to be completed within the first two weeks from the day of beginning of7th semester
3. The group has to identify and select the problem to be addressed as their project work. make through literature survey and finalize a comprehensive aim and scope of their work to be done.
4. A project report has to be submitted by each student group for their project work.
5. Three reviews have to be conducted by a team of faculty (minimum of 3 and maximum of 5) along with their faculty guide as a member of faculty team (for monitoring the progress of project planning and implementation).

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- formulate a real world problem, identify the requirement and develop the design solutions.
- identify technical ideas, strategies and methodologies.
- utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- test and validate through conformance of the developed prototype and analysis the cost effectiveness.

TOTAL PERIODS 90

CO/PO Mapping

Mapping of Course Outcomes with Programme Outcomes (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
CO	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	3	-	-	-	-	-	-	-
CO2	3	3	2	1	1	2	3	2	1	2	2	1	1	1
CO3	3	3	2	2	1	2	3	3	1	-	1	2	1	2
CO4	3	3	3	3	2	1	3	3	1	-	1	2	1	3

SEMSTER VIII

CY20801 **MALWARE ANALYSIS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- analyze the malware and its functionalities
- Assess the threat associated with malicious documents
- explore the techniques for detecting, analyzing, reverse engineering
- analyze the code for malware
- perform malware forensics

UNIT I MALWARE ANALYSIS 9

Basic Static Techniques - Malware Analysis in Virtual Machines - Basic Dynamic Analysis - Analyzing Malicious Windows Programs.

UNIT II MALWARE FUNCTIONALITY 9

Malware Behavior - Covert Malware Launching - Data Encoding - Malware - Focused Network Signatures.

UNIT III ANTI-REVERSE-ENGINEERING 9

Anti-Disassembly; Anti-Debugging; Anti-Virtual Machine Techniques; Packers and Unpacking

UNIT IV CODE ANALYSIS 9

Shell code Analysis - C++; Analysis - 64-Bit Malware; Tools for Malware Analysis.

UNIT V MALWARE FORENSICS 9

Using TSK for Network and Host Discoveries - Using Microsoft Offline API to Registry Discoverie Identifying Packers using PEiD; Registry Forensics with Reg Ripper Plugins - Bypassing Poison Ivy's Locke Files, Bypassing Conficker's File System ACL Restrictions , Detecting Rogue PKI Certificates.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- identify various malwares and understand the behavior of malwares in real world applications.
- implement different malware analysis techniques.
- analyze the malware behavior in windows and android.
- understand the purpose of malware analysis.
- identify the various tools for malware analysis.

TEXTBOOKS

1. Michael Sikorski and Andrew Honig, “Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software”, No Starch Press, 2012.

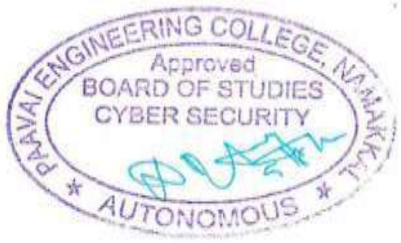
REFERENCES

1. Jamie Butler and Greg Hoglund, “Rootkits: Subverting the Windows Kernel”, Addison-Wesley, 2005.
2. Dang, Gazet, Bachaalany, “Practical Reverse Engineering”, Wiley, 2014.
3. Reverend Bill Blunden, “The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System” Second Edition, Jones & Bartlett, 2012.

CO/PO MAPPING

Mapping of Course Outcomes with Programme Outcome
(1,2,3 indicates the strength of correleation)(1-LOW; 2-MEDIUM; 3-HIGH)

CO	Programme Outcome (POs)												Programme Specific Outcome (PSO)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	1	-	-	-	1	1	2	3	2
CO2	2	2	1	1	1	1	-	-	-	1	1	1	3	2
CO3	3	2	3	1	1	1	1	-	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	-	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	-	2	1	1



CY20802	PROJECT WORK	0 0 12 6

COURSE OBJECTIVES

To enable students to

- recognize the significance of proper scope and the problems.
- understand the strategic plans, project prioritization methods and projects.
- understand the importance of scheduling / allocating resources to a project.
- develop strategies for developing and reinforcing high performance teams.

GUIDELINES

1. The students are expected to get formed into a team of convenient groups of not more than 3 members son a project.
2. Every project team shall have a guide who is the member of the faculty of the institution. Identification of student group and their faculty guide has to be completed within the first two weeks from the day of beginning of 8th semester.
3. The group has to identify and select the problem to be addressed as their project work make through literature survey and finalize a comprehensive aim and scope of their work to be done.
4. A project report has to be submitted by each student group for their project work.
5. Three reviews have to be conducted by a team of faculty (minimum of 3 and maximum of5) along with their faculty guide as a member of faculty team (for monitoring the progress of project planning and implementation).

TOTAL PERIODS 180

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- prepare a literature survey in a specific domain as a team / individual tomotivate lifelong learning.
- identify the problem by applying acquired knowledge.
- choose efficient tools for designing project modules.
- design engineering solutions to complex problems utilizing a systemsapproach and combine all the modules for efficient testing.

CO/PO MAPPING:

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	2	1	1	1	1	-	-	-	1	1	2	3	2
CO2	2	2	1	1	1	1	-	-	-	1	1	1	3	2
CO3	3	2	3	1	1	1	1	-	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	-	1	2	3

PROFESSIONAL ELECTIVE COURSES (PE-III)

CY20351 SECURITY GOVERNANCE, RISK AND COMPLIANCE 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the concepts of Cyber security, IT Service Management, and Business Continuity.
- learn the International Standards Management Systems such as the ISO 27001.
- be assess cyber security risks and recommend risk treatment options in line with organizational risk appetite
- learn the risk the ethical hacking steps and requisite counter measure while considering risk assessment.
- gain knowledge about the People, Process and Technology elements that underpin the various management systems.

UNIT I INTRODUCTION 9

Introduction to Cyber Security - Conceptual Description of Governance, Risk and Compliance; IT Governance Frameworks and Strategic Planning; Governance Models; MIT Sloan School of Management and ISO 38500.

UNIT II INFORMATION SECURITY 9

Understanding of IT Governance - 3 Waves; Information Security; Cyber Security Context, Cyber Security Components; Introduction to ISO 27001.

UNIT III ETHICAL HACKING AND RISK MANAGEMENT 9

Ethical Hacking and Risk Management - Security Policy Management; Security Architecture Design; Security Awareness Program Design; Security Technologies.

UNIT IV SERVICE MANAGEMENT 9

Introduction to Service Management - Service Management Frameworks; ITIL and ISO 20000 ; Build of IT Service Management System.

UNIT V BUSINESS CONTINUITY MANAGEMENT 9

Introduction to Business Continuity Management - Building a Business Continuity Management system using ISO 22301; Case Study Discussion and Careers in Cyber Security.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end this course, students will be able to

- describe the cybersecurity goals to strategic business goals
- determine the high-level cybersecurity policy objectives
- interpret the cybersecurity risks and recommend risk treatment options in line with organizational risk appetite
- demonstrate the appropriate risk mitigation techniques and control measures
- analyze organizational compliance to cybersecurity standards and related frameworks

TEXTBOOKS

1. Douglas W. Hubbard and Richard Series ," How to Measure Anything in Cybersecurity Risk", John Wiley & Sons,2016.
2. Antony Tarantino, Governance, Risk, and Compliance Handbook: Technology, Finance,2015 Environmental, and International Guidance and Best Practices,2009

REFERENCES

1. Antony Tarantino, Governance, Risk, and Compliance Handbook: Technology, Finance, Environmental, and International Guidance and Best Practices,2009
2. Scott Donaldson and Stanley Siegel," Enterprise Cybersecurity",2018
3. CSX Cybersecurity Fundamentals Study Guide by ISACA,2018
4. Richard Steinberg,"Governance,Risk ,Management & Compliance",2nd edition,2017.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	2	-	2	1	1	2	3	2
CO2	2	2	1	1	1	1	-	-	-	1	1	1	3	2
CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

CY20352 **CLOUD COMPUTING** 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the concept of cloud computing
- appreciate the evolution of cloud from the existing technologies
- grasp knowledge on the various issues in cloud computing.
- be familiar with the lead players in cloud
- appreciate the emergence of cloud as the next generation computing paradigm.

UNIT I INTRODCUTION 9

Introduction to Cloud Computing–defining a cloud, the cloud computing reference model, characteristics and benefits of cloud computing, historical developments, building cloud computing environments, computing platforms and technologies, principles of parallel and distributed computing.

UNIT II CLOUD ENABLING TECHNOLOGIES 9

Basics of Virtualization – characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and computing - pros and cons of virtualization – technology examples: para virtualization, full virtualization.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 9

Cloud Reference Model: Infrastructure / Hardware as a Service – Case Study, Platform as a Service – Case Study, Software as a Service – Case Study, Service provider, cloud storage -Types of Clouds: PublicClouds, Private Clouds, Hybrid Clouds, Community Clouds-Case Study- Economics of the Cloud, Open Challenges.

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 9

Inter Cloud Resource Management -Resource Provisioning and Resource Provisioning Methods - Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9

Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine —Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- learn the key and enabling technologies that help in the development of cloud.
- develop the ability to understand the architecture of compute and storage cloud, service and delivery models.
- learn the core issues of cloud computing such as resource management and security.
- evaluate and choose the appropriate technologies, and approaches for implementation and use of cloud.

TEXTBOOKS

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security, CRC Press, 2017.

REFERENCES

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, TataMcgraw Hill, 2009

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	2	-	2	1	1	2	3	2
CO2	2	2	1	1	1	1	-	-	-	1	1	1	3	2
CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

CY20353 BIG DATA ANALYTICS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know the fundamental concepts of big data and analytics.
- explore tools and practices for working with big data.
- learn about stream computing.
- know about the research that requires the integration of large amounts of data.
- learn NoSQL databases and management.

UNIT I INTRODUCTION TO BIG DATA 9

Evolution of Big data; Best Practices for Big data Analytics; Big data characteristics; Validating; The Promotion of the Value of Big Data; Big Data Use Cases; Characteristics of Big Data Applications - Perceptionand Quantification of Value; Understanding Big Data Storage ; HDFS; MapReduce and YARN– Map Reduce Programming Model.

UNIT II CLUSTERING AND CLASSIFICATION 9

Advanced Analytical Theory and Methods- Overview of Clustering , K-means , Use Cases; Overview of the Method - Determining the Number of Clusters, Diagnostics, Reasons to Choose and Cautions; Classification-Decision Trees, Overview of a Decision Tree, The General Algorithm, Decision Tree Algorithms, Evaluating a Decision Tree, Decision Trees in R; Naïve Bayes – Bayes' Theorem, Naïve Bayes Classifier.

UNIT III ASSOCIATION AND RECOMMENDATION SYSTEM 9

Advanced Analytical Theory and Methods- Association Rules, Overview, Apriori Algorithm, Evaluation of Candidate Rules; Finding Association& finding similarity; Recommendation System- Collaborative Recommendation, Content Based Recommendation, Knowledge Based Recommendation, Hybrid Recommendation Approaches.

UNIT IV STREAM MEMORY 9

Introduction to Streams Concepts; Stream Data Model and Architecture - Stream Computing, Sampling Data ina Stream, Filtering Streams, Counting Distinct Elements in a Stream; Estimating moments; Counting onenessin a Window – Decaying Window; Real time Analytics Platform (RTAP) applications; Case Studies; Real Time Sentiment Analysis.

UNIT V NO SQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION 9

NoSQL Databases- Schema-less Models; Increasing Flexibility for Data Manipulation; Key Value Stores-Document Stores, Tabular Stores, Object Data Stores; Graph Databases Hive;

Sharding; HBase – Analyzing big data with twitter; Big data for E-Commerce; Big data for blogs; Review of Basic Data Analytic Methods using .R

TOTAL PERIODS 45

COURSE OUTCOMES

At the end this course, students will be able to

- work with big data tools and its analysis techniques.
- analyze data by utilizing clustering and classification algorithms.
- learn and apply different mining algorithms and recommendation systems for large volumes of data.
- perform analytics on data streams.
- learn NoSQL databases and management.

TEXTBOOKS

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

2. David Loshin," Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL and Graph", Morgan Kauffmann/Elsevier Publishers, 2013

REFERENCES

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.

2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.

3. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010

4. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers" CRC Press, 2015.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**												**Programme Specific Outcomes (PSOs)**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	1	1	2	-	2	1	1	2	3	2
CO2	2	2	1	1	1	1	-	-	-	1	1	1	3	2
CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

CY20354 **SOFTWARE TESTING** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- understand standard principles to check the occurrence of defects and its removal.
- learn the various design analysis methods.
- know the behaviour of the testing techniques to detect the errors in the software.
- be familiar with the concepts of test and defect controlling.
- learn the functionality of automated testing tools.

UNIT I INTRODUCTION 9

Testing as an Engineering Activity - Role of Process in Software Quality - Testing as a Process-asic. Definitions: Software Testing Principles, tester's role in software development organization. Origins of defects - defect classes, defect repository and test design, analysis of defect for a project.

UNIT II TESTING DESIGN STRATEGIES 9

Introduction to Testing Design Strategies - Black Box testing, Random Testing, Equivalence Class artitioning, Boundary Value Analysis. White-Box testing, Test Adequacy Criteria, Coverage and Control Flow Graphs, Covering Code Logic Paths - Case study: Additional White box testing approaches.

UNIT III LEVELS OF TESTING 9

Need for Levels of Testing- Unit Test, designing unit tests - Integration tests, designing integration Tests - System Testing, types of system testing – Acceptance Testing – Performance Testing - Regression Testing. Alpha -Beta and Acceptance Test- Usability and Accessibility test – Website testing.

UNIT IV TEST AND DEFECT MANAGEMENT 9

Test Management- Documenting test plan and test case, effort estimation, configuration management, project progress management. Use of testopia for test case documentation and test management –Test Planning - Test Plan Components, test plan attachments, locating test items reporting test results.

UNIT V TEST AUTOMATION 9

Introduction to automation testing, why automation, what to automate, skills needed for automation, design and architecture for automation, tools and result modules - Introduction to Selenium, Basics of Automation testing using selenium, using selenium IDE for automation testing.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- apply software testing fundamentals and testing design strategies to enhance software quality.
- implement the different analysing techniques in software design.
- impart knowledge in identifying suitable tests to be carried out.
- understand, plan and document the defect control procedures.
- explore the test automation concepts and tools.

TEXT BOOKS

1. Srinivasan Desikan and Gopalaswamy Ramesh, " Software Testing - Principles and Practices",Pearson education, 2006.
2. Rex Black (2001), Managing the Testing Process (2nd edition), John Wiley & Sons.

REFERENCES

1. AdityaP.Mathur, "Foundations of Software Testing", Pearson Education, 2008.
2. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007.
3. Foundations of software testing ,Dorothy Graham, Erik van Veenendaal, Isabel Evans, RexBlack,2008.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
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CO1	3	2	1	1	1	1	2	-	2	1	1	2	3	2
CO2	2	2	1	1	1	1	-	-	-	1	1	1	3	2
CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

PROFESSIONAL ELECTIVE COURSES (PE-IV)

CY20451 SECURITY AUDIT AND RISK ASSESSMENT 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- Understand the security audit planning strategies
- Gain knowledge about information risk
- Discover knowledge in collecting data about organization
- Acquire knowledge in various analysis on Information Risk Assessment
- Introduce the System Risk analysis

UNIT I SECURITY AUDIT PLANNING 9

Need for Audit Planning - Steps in Audit Planning- Audit Risk Assessment- Performing Audit- Internal Controls- Audit Evidence- Audit Testing- Follow up activities- Security Monitoring and Auditing- Assurance and Trust- Need for Assurance- Role of Requirements in Assurance- Audit Assurance in SoftwareDevelopment Phases- Building Secure and Trusted Systems- Designing an Auditing System- Auditing to detect Violations of a Security Policy- Auditing Mechanisms- Audit Browsing.

UNIT II INFORMATION RISK 9

What is Risk- Going Deeper with Risk- Components of Risk- Putting it Altogether- Information Security Risk- Information Security Risk Assessment Overview- Assess Information Security Risk- Risk assessment and security Program- Information Security Management in a Nutshell- Drivers, Laws and Regulations- Federal Information Security Management- Gramm-Leach-Blile (GLBA)- Health Insurance Portability and Accountability Act(HIPAA)- State Governments- ISO 27001- Drivers, Laws and Regulations- Risk Assessment Framework- Practical Approach.

UNIT III DATA COLLECTION AND RISK SCHEDULING 9

Data Collection-Introduction- The Sponsor- The Project Team- The size and Breadth of the Risk Assessment- Scheduling and Deadlines- Assessor and Organization Experience- Work load- Data Collection Mechanisms- Collectors- Containers- Executive Interview- Document Requests- IT Asset Inventories- Asset Scoping- Business Impact Analysis and Other Assessments Critical Success Factor Analysis- Profile & Control Survey- Consolidation.

UNIT IV INFORMATION RISK ASSESSMENT 9

Compiling Observations from Organizational- Risk Documents- Preparation of Threat and Vulnerability Catalogs- Threat Catalog- Vulnerability Catalogs- Threat Vulnerability Pairs- Overview of the System Risk Computation- Designing the Impact Analysis Scheme- Confidentiality, Integrity- Availability- Preparing the Impact Score- Designing the Control analysis Scheme- Designing the Likelihood Analysis Scheme- Exposure- Frequency- Controls- Likelihood- Final Risk Score.

UNIT V SYSTEM RISK ANALYSIS

9

System Risk Analysis- Risk Classification- Risk Rankings- Risk Prioritization and Treatment- Review of Audit Findings- Review of Security Incidents- Review of Security Exceptions- System Specific Risk Treatment- information Security Risk Assessment Reporting- Risk Analysis Executive Summary- Methodology- Organizational- System Specific- Results- Organizational Analysis- System Specific- Risk Register- Post Mortem.

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of this course, students will be able to

- acquire the knowledge on various secure auditing techniques
- acquire the ability to identify knowledge in information risk
- understand the basic ideas about data collection workload
- appreciate the concepts of vulnerability catalogs and impact analysis scheme
- identify the knowledge in risk classification technique

TEXT BOOKS

1. Mark Talabis, "Information Security Risk Assessment Toolkit: Practical Assessments through Data Collectionand Data Analysis", Syngress; 1st Edition. ISBN:978-1-59749-735-0. Nov2012
2. David L. Cannon, "CISA Certified Information Systems Auditor Study Guide", SYBEX Publication.ISBN:978-0-470-23152-4.

REFERENCES

1. Thomas R.Peltier, "Information Security Risk Analysis", CRC Press, 20012. Schank Roger C.

Mapping of Course Outcomes with Programme Outcomes
(1/2/3 indicates strength of correlation) 3-strong, 2-Medium, 1-Weak

COs	Programme Outcomes POs												Programme Specific Outcomes PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	2	3
CO2	3	3	2	3	-	-	-	-	-	-	-	1	3	3
CO3	3	2	2	2	-	-	-	-	-	-	-	1	2	3
CO4	3	2	3	2	-	-	-	-	-	-	-	1	3	3
CO5	3	2	2	2	-	-	-	-	-	-	-	1	2	2

CY20452 SECURE SOFTWARE DEVELOPMENT LIFE CYCLE 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- identify project security risks & selecting risk management strategies.
- analyze software security standards, policies, and guidelines to articulate and elaborate requirements.
- analyze and test existing code and reduce vulnerabilities.
- select and integrate established security design patterns and address threat assessments to mitigate common vulnerabilities and achieve the target design.
- participate in team-based peer reviews to analyze the security development life cycle and mitigate risks and vulnerabilities.

UNIT I INTRODUCTION 9

Software Engineering - Process model; Agile development - Agile Process, Extreme Programming; Need to secure development life cycle, Current Software Development Methods Fail to Produce Secure Software, Incentive to Review Code, Understanding Security Bugs, Critical Mass; Proprietary Software Development Methods - CMMI, TSP, and PSP; SDL for Management - Managing the SDL; Case study - A Short History of the SDL at Microsoft.

UNIT II RISK MANAGEMENT 9

A Risk Management Framework - The Five Stages of Activity, Understanding the Business Context, Gathering the Artifacts, Identifying the Business and Technical Risks, Synthesizing and Ranking the Risks; Defining the Risk Mitigation Strategy, Carrying Out Fixes and Validating; The Importance of Measurement -The Critical Workbench.

UNIT III RISK ANALYSIS PRACTICES 9

Introduction to Architectural Risk Analysis - Common Themes among Security Risk Analysis Approaches, Traditional Risk Analysis Terminology, Knowledge Requirement; The Necessity of a Forest-Level View - A Traditional Example of a Risk Calculation, Modern Risk Analysis; Touchpoint Process - Architectural Risk Analysis, Limitations of Traditional Approaches, Getting Started with Risk Analysis.

UNIT IV CODE REVIEW PROCESS 9

Code Review with a Tool - Catching Implementation Bugs with a Tool; Approaches to Static Analysis- Modern Rules, Tools from Research land; Commercial Tool Vendors- Key Characteristics of a Tool; The Fortify Knowledge Base - Touchpoint Process; Code Review - Use a Tool to Find Security Bugs.

UNIT V SYSTEM RISK ANALYSIS 9

System Risk Analysis- Risk Classification- Risk Rankings- Risk Prioritization and Treatment- Review of Audit Findings- Review of Security Incidents- Review of Security Exceptions- System Specific Risk Treatment- information Security Risk Assessment Reporting- Risk Analysis Executive Summary- Methodology- Organizational- System Specific- Results- Organizational Analysis- System Specific- Risk Register- Post Mortem.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- Acquire the knowledge on various secure auditing techniques
- Acquire the ability to identify knowledge in information risk
- Understand the basic ideas about data collection workload
- Appreciate the concepts of vulnerability catalogs and impact analysis scheme
- Identify the knowledge in risk classification technique

TEXT BOOKS

1. Mark Talabis, "Information Security Risk Assessment Toolkit: Practical Assessments through Data Collection and Data Analysis", Syngress; 1st Edition. ISBN:978-1-59749-735-0. Nov2012.
2. David L. Cannon, "CISA Certified Information Systems Auditor Study Guide", SYBEX Publication. ISBN:978-0-470-23152-4.

REFERENCES

1. Thomas R.Peltier, "Information Security Risk Analysis", CRC Press, 20012. Schank Roger C.,

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
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CO1	3	2	1	1	1	1	2	-	2	1	1	2	3	2
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CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

CY20453 **INFORMATION VISUALIZATION** 3 0 0 3

COURSE OBJECTIVES

- To understand the concepts and significance of data visualization.
- To learn the visualization idioms and map data attributes to graphical attributes.
- To evaluate the effectiveness of visualization designs.
- To comprehend the considerations in information dashboard design.

UNIT I Introduction 9

Visualization Definition and Need – Data Abstraction – Data Semantics and Types – Data Types – Dataset Types (DL) – Attribute Types – Semantics – Task Abstraction – Analyze tasks abstractly – Actions– Targets – Analyzing and Deriving.

UNIT II Analysis 9

Four levels for Validation – Reasons to Validate – Four levels of Design – Angles of Attack – Threats to Validity – Validation Approaches – Validation Examples – Marks and Channels – Defining Marks and Channels – Using Marks and Channels – Channel Effectiveness – Relative versus Absolute Judgements – Rules of Thumb to be followed – No unjustified 3D - No unjustified 2D – Eyes beat memory – Resolution over Immersion – Overview, Zoom,
Filter, Details on demand – Responsiveness is required – Get it Right in Black and White.

UNIT III Tables and Spatial Data 9

Arrange by Keys and Values – Express: Quantitative Values – Separate, Order, and Align: Categorical Regions – Matrix Alignment: Two Keys – Volumetric Grid: Three Keys – Recursive Subdivision: Multiple Keys – Spatial Axis Orientation – Spatial Layout Density – Arrange Spatial data – Geometry – Scalar Fields: One Value – Vector Fields: Multiple Values
– Tensor Fields: Many Values.

UNIT IV Networks, Trees, Map Color 9

Connection: Link Marks – Matrix Views - Connection versus Matrix – Containment: Hierarchy Marks – Map Color and Other Channels – Color Theory – Color maps – Other Channels – Reduce items and attributes – Reasons to Reduce - Filter – Aggregate – Manipulate View – Reasons for Change - Change View over Time – Select Elements –
Navigate: Changing Viewpoint, Reducing Attributes.

UNIT V INFORMATION DASHBOARD DESIGN 9

Clarifying the Vision-Variations in Dashboard Uses and Data – Common Mistakes in Dashboard Design – Fundamental considerations in dashboard design – Power of Visual perception-Key Goals in the Visual Design process-. Dashboard Display Media

TOTAL PERIODS 45

TEXT BOOKS

1. Tamara Munzner, "Visualization Analysis and Design", CRC Press, 2014.
2. Stephen Few, "Information Dashboard Design: Displaying Data for At-a-glanceMonitoring", Analytics Press, Second Edition, 2013.

REFERENCES

1. Alexander Telea, "Data Visualization Principles and Practice", CRC Press, Second Edition, 2014.
2. Andy Kirk, "Data Visualization: A Successful Design Process", PACKT Publishing, 2012.
3. Karl Pover, "Leaning Qlik View Data Visualization", PACKT, 2013.
4. Stephen Few, "Show Me the Numbers: Designing Tables and Graphs to Enlighten", Analytics Press, Second Edition, June 2012.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
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CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

CY20454 **ANDROID SECURITY** 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- identify about android security model.
- know about application security.
- learn about permissions and credential storage.
- understand the android vulnerabilities.
- analyze network, enterprise and device security.

UNIT I INTRODUCTION

Introduction to Android - Android API, DVM; APK File Structure - Basic Analysis of an APK, Dex structure, Dex Structure Parsing, APK install process; Android Root - Android's architecture, Android's Security Model.

UNIT II APPLICATION SECURITY 9

Inspecting the Android Manifest.xml file - Introduction to Android Debugging Tools and Their Usage, interacting with the Activity Manager via ADB; Inspecting Application Certificates and Signatures - Verifying Application Signatures - Signing Android Applications -Mobile Security.

UNIT III PERMISSIONS AND CRYPTOGRAPHIC PROVIDERS, CREDENTIAL STORAGE 9

Nature of Permissions - Requesting Permissions, Permission Management, Permission Protection levels, Permission Assignment; Permission Enforcement - System permissions, Shared user ID, Custom Permissions; Public and private Components - Activity and service Permissions, Broadcast permissions, Content provider permissions, Pending intents.

UNIT IV ANDROID MALWARE VULNERABILITY, PACKAGE MANAGEMENT USER MANAGEMENT 9

Master Key Vulnerability - File Name Length Vulnerability Introduction to Obfuscation, DEX Code Obfuscation; Package management - package format, code signing, Apk install process, package verification; User management - Multiuser support, types of user, user management ,user metadata, per user application management, external storage, other multiuser features.

UNIT V NETWORK SECURITY AND PKI, ENTERPRISE LEVEL SECURITY AND DEVICE SECURITY 9

NETWORK SECURITY - PKI and SSL Overview, JSSE Introduction Android JSSE Implementation; ENTERPRISE SECURITY - Device administration, VPN support, WiFi EAP; DEVICE SECURITY - Controlling OS and bootup installation, verified boot, disk encryption, screen security, secure USB debugging, Android backup , NFC and secure elements.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- explain about android security model.
- describe application security.
- elaborate about permissions and credential storage.
- elucidate about android vulnerability and user, package management.
- discuss network, enterprise and device security.

TEXTBOOKS

1. Nikolay Elenkov, "Android Security Internals - An In Depth Guide to Android Security Architecture",No Starch Press, 2015.

2. Anmol Misra, Abhishek Dubey." Android Security Attacks and Defenses"",Auerbach Publications,2016

REFERENCES

1. Keith Makan, Scott Alexander-Bown," Android Security Cookbook", Packt Publishers, 2013.
2. Erik Hellman, "Android Programming Pushing the Limits", Wiley Publishers, 2014.
3. Jeff Six, "Application Security for the Android platform ",O'Reilly Media Publishers,2016.
4. Pragati Ogal Rai," Android application security essentials", Packt Publishers,2013.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**												**Programme Specific Outcomes (PSOs)**	
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CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

PROFESSIONAL ELECTIVE COURSES V

CY20551 **SECURE SOFTWARE DESIGN** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- acquire a knowledge of secure software vulnerabilities and different environments.
- understand the concepts of security analysis in software design.
- understand about security programming and web application threats.
- realize the concepts of security design.
- understand various security testing and quality assurance.

UNIT I INTRODUCTION **9**

Introduction to Secure Design - Identify software vulnerabilities - Current and Emerging Threats - The Network Environment - The Operating System Environment - The Database Environment.

UNIT II SOFTWARE SECURITY ANALYSIS **9**

Security Requirements Planning - Vulnerability Mapping - Incorporating SSD with the SDLC - Personnel Training.

UNIT III SECURITY PROGRAMMING PRACTICES **9**

Programming Languages - A Culture of Security - Web Application Threats - Secure Data Management - Zero Day and Beyond.

UNIT IV SOFTWARE SECURITY DESIGN CONCEPTS **9**

Security Design Principles - Key Aspects of Software Security - Economy of mechanism - Separation ofprivilege - Least privilege - Least common mechanism - Psychological acceptability.

UNIT V SECURITY TESTING AND QUALITY ASSURANCE **9**

Security Risk Assessment and Threat Modeling - Static Application Security Testing (SAST) and Dynamic Application Security Testing(DAST) - Infra Penetration Testing and DB Security Testing - API/Web Services Security Testing & Cloud specific non-invasive tests - Determining Risk and Severity - Security incident management-Security audit services.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of the course, the students will be able to

- understand Software process vulnerabilities for an organization and design and develop multi-tier solution of a problem.
- develop knowledge about usage of vulnerability mapping and personnel training of security.

- use the knowledge and the process of security design programming and practices.
- describe the use of security design principles and concepts.
- Implement the various security testing methodologies and assure the quality of secure software.

TEXTBOOKS

1. Theodor Richardson, Charles N Thies, "Secure Software Design", 3rd edition, Jones & Bartlett Publication- 2012.
2. Loren Kohnfelder, Adam shostack, "Designing Secure Software", 3rd Edition, William Pollock 2021.

REFERENCES

1. Jason Grembi "Developing Secure Software", Cengage Learning India Pvt Lts 2009.
2. Phu Hong Nguyen, "Model-based Secure Software Development with Modularity Reusability", Lambert Academic Publishing, 2019.
3. Dijiang Huang, Ankur Chowdhary, Sandeep Pisharody," Software-Defined Networking and Security", CRC Press, Mar 31, 2021.
4. Gerardus Blokdyk, "Software Security Vulnerability A Complete Guide "2020 Edition, Jan 18, 2021.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

CY20552 REVERSE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- acquire knowledge about fundamentals of reverse engineering.
- understand the concepts of low level software
- identifying and authenticating reversing tools.
- realize the concepts of reversing malware.
- gain knowledge about anti-reversing techniques.

UNIT I FOUNDATIONS 9

Need for Reverse Engineering - Software Reverse Engineering, Reverse Applications, The Reversing Process, The Tools, Is Reversing Legal and Code Samples Tools, Object Flow Graph; Abstract Language - Object Flow Graph, Containers, Flow Propagation Algorithm, Object Sensitivity, Low Level Software, Low Level Perspectives, Assembly Language, A Primer on Compilers and Compilation, Execution Environments.

UNIT II REVERSING TOOLS 9

Different Reversing Approaches - Disassemblers, Debuggers, Decompiles, System; Monitoring Tools - Patching Tools, Miscellaneous Reversing Tools.

UNIT III BEYOND THE DOCUMENTATION 7

Reversing and Interoperability, Laying the Ground Rules, Locating Undocumented APIs, Case Study.

UNIT IV CLASS, OBJECT, INTERACTION AND STATE DIAGRAMS 9

Class Diagram - Recovery, Declared Vs Actual Types, Containers, Object Diagram; Introduction - Object Sensitivity, Dynamic Analysis, Interaction Diagram; Introduction - Interaction Diagram Recovery, Dynamic Analysis.

UNIT V PACKAGE DIAGRAM, REVERSING AND ANTI REVERSING TECHNIQUES 11

Package Diagram - Recovery, Clustering, Concept Analysis, Tool Architecture, Reversing Malware; Types of malware - Sticky software, Future malware, Uses of malware, Malware vulnerability, Polymorphism, Metamorphism, establishing a secure environment, Anti Reversing Techniques; Introduction to Anti reversing - Basic approaches to anti reversing, Eliminating symbolic information, Code encryption, Active anti debugger techniques, Confusing Disassemblers, Code obfuscation, Control flow transformations, Data transformations.

TOTAL HOURS 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- finding malicious code.
- discovering unexpected flaws and faults.
- finding the use of others code.
- learning from other products of a different domain or purpose.
- analyse well designed Software System.

TEXTBOOKS

1. Paolo Tonella &Alessandra Potrich, "Reverse Engineering of Object-Oriented Code", Springer, 2005.
2. Eldad Eilam, "Reversing: Secrets of Reverse Engineering", Wiley, 2005.

REFERENCES

1. Bruce Dang, Alexandre Gazet, Elias Bachaalany, Practical Reverse Engineering, 2014, John Wiley & Sons, Inc.
2. Michael Sikorski, Andrew Honig, "Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software", 2012, No Starch Press, Inc.
3. The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System 2nd Edition, 2011.
4. Bill Blunden, "The Rootkit Arsenal" Escape and Evasion in the Dark corners of the system, 2nd edition, 2013.

CO-PO MAPPING:

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	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	1	1	2	-	2	1	1	2	3	2
CO2	2	2	1	1	1	1	-	-	-	1	1	1	3	2
CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

CY20553 BIOMETRICS AND SECURITY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- provide students with understanding of biometrics, biometric equipment and standards applied to security.
- identifying and authenticating individuals in a reliable and fast way through unique biological characteristics.
- understand the biometric matching methods.
- select Biometrics for a System.
- understand authentication with passwords for Biometrics.

UNIT I INTRODUCTION EQUIPMENT AND STANDARDS 9

Biometrics Introduction - benefits of biometrics over traditional authentication systems, benefits of biometrics in identification systems, selecting a biometric for a system, Applications; Key biometric terms and processes, biometric matching methods, Accuracy in biometric systems.

UNIT II IDENTIFYING AND AUTHENTICATING INDIVIDUALS 9

Physiological Biometric Technologies - Fingerprints, Technical description, characteristics; Competing technologies - strengths, weaknesses, deployment - Facial scan; Technical description - characteristics, weaknesses, deployment, Iris scan.

UNIT III BIOMETRIC MATCHING METHODS 9

Technical description – characteristics, strengths, weaknesses, deployment; Hand scan - Technical description, characteristics, strengths, weaknesses, deployment; DNA biometrics - Behavioural Biometric Technologies, Handprint Biometrics, DNA Biometrics.

UNIT IV BIOMETRICS FOR A SYSTEM 9

Signature and handwriting technology - Technical description, classification, keyboard / keystroke dynamics; Voice - data acquisition, feature extraction, characteristics, strengths, weaknesses, deployment.

UNIT V AUTHENTIATION FOR BIOMETRICS 9

Multi biometrics and multi factor biometrics - two-factor authentication with passwords, tickets and tokens, executive decision, implementation plan.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
- understand and analyse biometric systems at the component level and be able to analyse ad design basic biometric system applications.
- able to work effectively in teams and express their work and ideas orally and in writing.
- identify the sociological and acceptance issues associated with the design and implementation ofbiometric systems.
- understand various Biometric security issues.

TEXTBOOKS

1. Samir Nanavathi, Michel Thieme, and Raj Nanavathi : "Biometrics -Identity verification ina network", 1st Edition, Wiley Eastern, 2002.
2. John Chirillo and Scott Blaul : "Implementing Biometric Security", 1st Edition, Wiley EasternPublication, 2005.

REFERENCES

1. John Berger: "Biometrics for Network Security", 1st Edition, Prentice Hall, 2004.
2. G r Sinha and Sandeep B. Patil, Biometrics: concepts and applications, Wiely, 2013.
3. Paul Reid, Biometrics for Network Security, Pearson Education.
4. Ruud M. Bolle, SharathPankanti, Nalini K. Ratha, Andrew W.Senior, Jonathan H. Connell, "Guide to Biometrics", Springer, 2009.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	2	-	2	1	1	2	3	2
CO2	2	2	1	1	1	1	-	-	-	1	1	1	3	2
CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

CY20554 **BLOCK CHAIN TECHNOLOGY** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the basic concepts of blockchain technology.
- procedure the mechanism of Cryptography in Cryptocurrency.
- understand the fundamentals of bitcoin and its applications.
- learn the standard rules and regulations of cryptocurrency.
- explore the applications of Blockchain to cryptocurrencies.

UNIT I BLOCKCHAIN 101 **9**

Distributed systems - The history of blockchain, Introduction to blockchain, definitions, elements, Features, Applications of blockchain technology, Tiers - Types of blockchain - Consensus in blockchain - CAP theorem - Benefits and limitations of blockchain.

UNIT II DECENTRALIZATION, CRYPTOGRAPHY AND TECHNICAL FOUNDATIONS **9**

Introduction - Cryptography, Confidentiality, Integrity, Authentication - Cryptographic primitives - Asymmetric cryptography - Public and private keys – RSA, Discrete logarithm problem, Hash functions, Elliptic Curve Digital signature algorithm.

UNIT III BIT COIN & ALTERNATIVE COINS **9**

Bitcoin - Transactions - Blockchain - Bitcoin payments - Alternative Coins - Theoretical foundations - Bitcoin limitations - Name coin -Litecoin - Primecoin - Zcash - Smart Contracts.

UNIT IV ETHEREUM 101 **9**

Introduction - Ethereum blockchain - Elements of the Ethereum blockchain - Precompiled contracts – Accounts, Block, Ether, Messages - Mining - Clients and wallets - The Ethereum network -Ethereum Development.

UNIT V HYPERLEDGER **9**

Projects - protocol - Hyperledger Fabric - Sawtooth lake - Corda - Blockchain - Outside of Currencies - Internet of Things, Government, Health, Finance.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- outline the history and different applications of blockchain.
- illustrate decentralization and practical aspects of cryptography.
- present bitcoin technology, alternative coins and smart contracts.
- develop a distributed application using Ethereum.
- deploy an application using Hyperledger.

TEXTBOOKS

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2ndEdition, Packt Publishing Ltd, March 2018.
2. Andreas Antonopoulos, "Mastering Bitcoin: Programming the open blockchain", 2nd Edition, O'Reilly Media, 2017.

REFERENCES

1. Brenn Hill, Samanyu Chopra & Paul Valencourt, "Blockchain Quick Reference: A guide to explor decentralized blockchain application development", Packet, 2018.
2. William Stallings, Network Security Essentials (Applications and Standards), Pearson Education, Inc 2017.
3. https://www.pearson.com/us/higher-education/product/Stallings-Cryptography-and-Network-SecurityPrinciples-and-Practice-5th-Edition/9780136097044.html.
4. https://www.lopp.net/pdf/princeton_bitcoin_book.pdf.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**												**Programme Specific Outcomes (PSOs)**	
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CO2	2	2	1	1	1	1	-	-	-	1	1	1	3	2
CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

PROFESSIONAL ELECTIVE COURSES VI

CY20651 CRIMINAL PSYCHOLOGY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- familiar with the field of Criminal Psychology.
- understand the origins of Criminal Behaviour.
- the role of Biological, Learning factors.
- acquire the knowledge of psychology, Frustration and Crime.
- learn the field of Criminal Behaviour in general.

UNIT I INTRODUCTION TO CRIMINAL PSYCHOLOGY 9

Theories of crime - Theoretical Perspectives on Human Nature; Disciplinary Perspectives in Criminology- Sociological Criminology, Psychological Criminology, Cognitive Criminology, Biological or Neurological Criminology, Developmental Approach, Psychiatric Criminology; Defining and Measuring Crime - Uniform Crime Reporting System, Sociological Criminology, UCR Problems.

UNIT II ORIGINS OF CRIMINAL BEHAVIOUR 9

Cumulative Risk Model - Developmental Cascade; Social Environmental Risk Factors - Poverty, Peer rejection and Association with Antisocial Peers, Gender Differences in Peer Rejection, Academic Failure; Parental Risk Factors - Psychological Risk Factors - Lack of Attention, Lack of Empathy, Animal Cruelty, Cognitive and Language Deficiencies, Intelligence and Delinquency.

UNIT III ORIGINS OF CRIMINAL BEHAVIOUR: BIOLOGICAL FACTORS 9

Genetics and antisocial Behaviour - Behaviour Genetics, Studies of Twins, Shared and Non-shared environments, Concordance, Molecular Genetics; Psycho Physiological Factors - Temperament, Features of temperament; Environmental Risk Factors – Neurotoxins, Mercury (Methyl mercury), Protective Properties of Micronutrients, Prenatal and Postnatal malnutrition, Nicotine, Alcohol and Drug Exposure.

UNIT IV ORIGINS OF CRIMINAL BEHAVIOUR: LEARNING AND SITUATIONAL FACTORS 9

Behaviourism - Skinner's Theory of Behaviour, Behaviourism as a Method of Science, Behaviourism as a Perspective of Human Nature, Skinnerian Concepts, Operant Learning and Crime; Social Learning - Expectancy Theory, Imitational Aspects of Social Learning, Differential Association, Reinforcement Theory, Frustration, Induced Criminality.

UNIT V CRIMINAL BEHAVIOUR FACTORS AND CASE STUDIES 9

The Socialized and Individual Offender - Frustration-Induced Riots, Frustration and Crime; Deindividuation -The Stanford Prison Experiment, The BBC Prison Study, Deindividuation and Crowd Violence, The Bystander Effect; Case Study - Process Model and Crime Control Model in The Criminal Justice System and Crime and Punishment Analysis.

TOTAL PERIODS 45

COURSE OUTCOME

Upon the completion of the course, the students will be able to

- understand the students about field of Criminal Psychology.
- analyse role of Criminal Behaviour and the origin of the concept.
- understand the role of Biological and Learning factors.
- students will become familiarize with basics of psychology, Frustration and Crime.
- students will become familiarize with the field of Criminal Behaviour in general.

TEXTBOOKS

1. Bartol C.R. and Bartol Anne M, "Criminal Psychology a PsychologicalApproach", Eleventh Edition, Global Edition, Pearson Education Limited, 2017.
2. Durrant, Russil, "An Introduction to Criminal Psychology, New York; Routledge", third edition, academic press, 2014.

REFERENCES

1. Hollin C.R. "Psychology and Crime an Introduction to Criminological Psychology, New York; Routledge", 2010.
2. Durrant Russil, "An Introduction to Criminal Psychology, New York; Routledge", second edition 2013.

3.Ray Bull, Claire Cooke, Ruth Hatcher and Jessica Woodhams, "Criminal Psychology a beginner's guide, second edition, One world Publications, 2006.

4.Robert forbes, "Criminal Psychology: Understanding the criminal mind and its Nature through criminal profiling", first edition, create space publishing, 2016.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**												**Programme Specific Outcomes (PSOs)**	
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CO1	3	2	1	1	1	1	2	-	2	1	1	2	3	2
CO2	2	2	1	1	1	1	-	-	-	1	1	1	3	2
CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

CY20652 SOFTWARE PROJECT MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the importance of project planning and project evaluation techniques.
- acquire knowledge in software effort estimation and calculating the project duration.
- analyze the risk and allocate the resources.
- gain knowledge about the monitoring and controlling the software projects and its quality.
- learn the fundamental concept of managing people and contracts.

UNIT I INTRODUCTION TO PROJECT PLANNING AND EVALUATION 9

Project Definition - Importance of Software Project Management, Software Projects Vs Other Projects ; Activities Covered by SPM - Setting Objectives, Stepwise Project Planning, Cost Benefit Evaluation Techniques.

UNIT II SOFTWARE EFFORT ESTIMATION AND ACTIVITY PLANNING 9

Software Effort Estimation - Agile Methods - Extreme Programming - Scrum - Problems with over and underestimates - Software effort estimation techniques - Bottom-up estimating, Top down Estimating, Estimating by analogy, Albrecht function point analysis; Activity Planning - Objectives of Activity planning, Project Schedules, Project and Activities, Sequencing and Scheduling - Activity on Arrow Networks, Forward Pass, Backward Pass, Identifying Critical Path, Activity Float, Shortening Project Duration.

UNIT III RISK MANAGEMENT AND RESOURCE ALLOCATION 9

Risk Management - Categories of Risk, A Framework for dealing Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Risk Evaluation; Applying the PERT technique; Resource Allocation - The nature of resources, Identifying Resource Requirements, Scheduling Resources; Creating critical paths – counting the cost, Publishing the resource schedule, The Scheduling Sequence.

UNIT IV MONITORING AND CONTROLLING OF PROJECTS AND ITS QUALITY 9

Monitoring and Controlling of Software Projects - Collecting the data, Visualizing Progress, Cost monitoring, Earned value analysis, Prioritizing monitoring; Software Quality - The importance of Software Quality, Software Quality Definition, ISO9126, Product Vs Process Quality Management, Process Capability Models, Techniques to help enhance software quality.

UNIT V MANAGING PEOPLE AND CONTRACTS 9

Managing people - Selection Process, instruction in the best methods, Motivational theorie; Maslow's Hierarchy of Needs – The Oldham - Hackman Job characteristic model, Becoming a Team, Decision Making, Managing Contracts; Types of Contract - Stages in contract placement, Typical terms of a Contract.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- select the project by applying various evaluation techniques.
- find the project duration by scheduling the activities.
- evaluate the risk and allocate the resources accordingly.
- monitor the progress of project and find the quality of project.
- motivate people and establishing a contract.

TEXTBOOKS

1. Bob Hughes, Mikecotterell, "software project management", Fifth edition, TataMcgraw Hill, 2009.

2. Watts s humphrey, "Managing the software process", pearson education inc, 2006.

REFERENCES

1. Walker Royce, "software project management", pearson education ,1999.
2. Nina s godbole, "software quality assurance: princles and practise", alpha science international ltd, 2004.
3. Gordon g schulmeyer," handbook of software quality assurance", 3rd edition, attach house publishers, 2007.
4. Ramesh, gopalaswamy, "managing global projects", tata mcgraw hill,2001.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	2	-	2	1	1	2	3	2
CO2	2	2	1	1	1	1	-	-	-	1	1	1	3	2
CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

CY20653 SOCIAL NETWORK ANALYSIS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the concept of semantic web and related applications.
- learn knowledge representation using ontology.
- analysis the importance of tool used for extraction and mining
- understand human behavior in social web and related communities.
- learn visualization of social networks.

UNIT I INTRODUCTION 9

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web – Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities- Web-based networks- Applicationsof Social Network Analysis.

UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 9

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework-Web Ontology Language- Modeling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data- Advanced representations.

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9

Understanding and predicting human behavior for social communities-User data management– Inference and Distribution - Enabling new human experiences - Reality mining - Context – Awareness - Privacy in online social networks-Trust in online environment-Trust models based on subjective logic– Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons-Attacks patrolman counter measures.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizingonline social networks, Visualizing social networks with matrix-based representations - Matrix andNode-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare – Collaboration networks - Co-Citation networks.

TOTAL PERIODS 45

COURSEOUTCOMES

At the end this course, students will be able to

- develop semantic web related applications.
- represent knowledge using ontology.
- analysed the extraction and mining tool of social network
- predict human behaviour in social web and related communities.
- visualize social networks.

TEXTBOOKS

1. PeterMika, "Social Networks and the Semantic Web", First Edition, Springer2007.
2. Borko Furht, Hand book of Social Network Technologies and Applications,1stEdition, Springer,2010.

REFERENCES

1. Guandong Xu, Yanchun Zhang and Lin Li, Web Mining and Social Networking –Techniques and applications, First Edition, Springer,2011.
2. Dion Gohand Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGIGlobalSnippet,2008.
3. John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web, Springer,2009.
4. Giles, Mark Smith, JohnYen, —Advances in Social Network Mining and Analysis, Springer,2010.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	2	-	2	1	1	2	3	2
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CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

CY20654	CLOUD SECURITY	3	0	0	3

COURSE OBJECTIVES

To enable the students to

- understand the concept of cloud computing
- learn about the cloud computing software security and fundamentals
- have knowledge on the various issue in cloud security
- able to identify security challenges
- methods to improve Cloud computing security architecture

UNIT I CLOUD COMPUTING FUNDAMENTALS 9

Essential Characteristics Architectural Influences - Technological Influences, Operational Influences, Outsourcing; IT Service Management - Cloud Computing Architecture - Cloud Services - Cloud Deployment Models.

UNIT II CLOUD COMPUTING SOFTWARE SECURITY FUNDAMENTALS 9

Cloud Information Security - Cloud Security Service - Cloud Security Design Principles - Secure Cloud Software Requirements - Cloud Security Policy Implementation and Decomposition - NIST 33 Security Principles - Secure Cloud Software Testing - Cloud Penetration Testing - Cloud Computing and BusinessContinuity Planning/Disaster Recovery.

UNIT III CLOUD COMPUTING RISK ISSUES 9

The CIA Triad - Privacy and Compliance Risks - Threats to Infrastructure, Data, and Access Control; Cloud Access Control Issues - Cloud Service Provider Risks.

UNIT IV CLOUD COMPUTING SECURITY CHALLENGES 9

Security Policy Implementation - Policy Types - Computer Security Incident Response Team (CSIRT) - Virtualization Security Management - Virtual Threats - VM Security Recommendations – VM - Specific Security Techniques

UNIT V CLOUD COMPUTING SECURITY ARCHITECTURE 9

Architectural Considerations - General Issues, Trusted Cloud Computing, Secure Execution Environments and Communications; Identity Management and Access Control Identity Management - Autonomic Security.

TOTAL PERIODS 45

CY20903 **FREE AND OPEN SOURCE SOFTWARE** 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the basics of open source software.
- gain the knowledge MySQL open source database
- able to familiar with Server - side programming language PHP
- able to implement and design the advanced Concepts in PHP.
- expose the students with the concept of perl programming

UNIT I INTRODUCTION 9

Introduction to Open sources – Need of Open Sources – Advantages of Open Sources– Application of Open Sources.

Open source operating systems: LINUX: Introduction – General Overview – Kernel Mode and user mode Process –Advanced Concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux. .

UNIT II OPEN SOURCE DATABASE 9

MySQL: Introduction – Setting up account – Starting, terminating and writing your own SQL programs – Record selection Technology – Working with strings – Date and Time– Sorting Query Results – Generating Summary – Working with metadata – Using sequences – MySQL and Web.

UNIT III OPEN SOURCE PROGRAMMING LANGUAGES 9

PHP: Introduction – Programming in web environment – variables – constants – data types – operators – Statements –Functions – Arrays – OOP – String Manipulation and regular expression –PHP and SQL database – PHP and LDAP -PHP Connectivity.

UNIT IV FILES 9

Files – Input and Output – Errors and Exceptions – Functions– Classes and OOP – Execution Environment. File handling and data storage – Sending and receiving E-mails – Debugging and Error handling – Security Templates.

UNIT V PERL 9

Perl backgrounder – Perl overview – Perl parsing rules – Variables and Data – Statements and Control structures – Subroutines, Packages, and Modules- Working with Files –Data Manipulation.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the cours , students will be able to

- configure the shell commands and programming
- demonstrate the wo king with MYSQL.
- demonstrate the simple application in PHP.
- create strong applicatio in PHP
- develop a simple problem & application in Perl programming

TEXT BOOKS

1. Richard Petersen,"The complete Reference Linux", Tata McGraw Hill Edition, Sixth edition 2010
2. Steve Suchring, MySQL Biblel, John Wiley, 2002.
3. Steven Holzner, "PHP: The Complete Reference", 2nd Edition, Tata McGraw - Hill Publishing Company Limited, Indian Reprint 2009.

REFERENCES

1. Mark G. Sobell. "Practical Guide to Fedora and Red HatEnterpriseLinux", 6 th Edition, Prentice Hall, 2011.
2. RasmusLerdorf and Levin Tatroe, "Programming PHP", O"Reilly 3rd Edition, 2011.
3. Remy Card, Eric Dumas and Frank Mevel, "The Linux Kernel Book", Wiley Publications, 2007.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcome (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
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CO3	3	2	3	1	1	1	1	1	1	1	-	1	2	1
CO4	2	2	3	2	1	1	1	-	1	1	1	1	2	3
CO5	3	2	2	1	1	1	1	-	1	1	1	2	1	1

CY20904	CYBER SECURITY ESSENTIALS	3	0	0	3

COURSE OBJECTIVES

To enable students to

- identify the importance of cyber safety.
- know about internet security.
- learn about different software problems and solutions.
- learn about protection in social media.
- identify the need of protecting reputation.

PRE REQUSITES:Nil

UNIT I INTRODUCTION TO CYBER SAFETY **9**

Cyber safety-introduction-paying attention to privacy and the need of encryption-monitoring online activity-identifying the devices used –when and where-using different window accounts-physical security.

UNIT II INTERNET SECURITY FUNDAMENTALS **9**

Security in web browser-Wi-Fi security and safety –the need of using strong and secure passwords-need of firewalls-types of firewalls-email safety and security: email protection and Gmail security.

UNIT III SOFTWARE PROBLEMS AND SOLUTIONS **9**

Introduction to different types of software problems –malware and viruses-antivirus-windows defender-antimalware-staying up-to-date-disaster recovery.

UNIT IV PROTECTION IN SOCIAL MEDIA **9**

Different types of Social media –securing social media :securing Facebook, securing twitter, securing you tube –finding online jobs –online resumes –work at home scams –securing linked in.

UNIT V PROTECTING REPUTATION **9**

Know the self-maintaining privacy-the real world and cyber space-what do after a security breach-digital legacy-protection with people: netiquette, anonymity-annoying, abusive people, online chatting. Protecting kids: passwords for kids, search engines, parental controls, location, cyberbullying and online predators.

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- describe the importance of Cyber Safety.
- explain about Internet Security.
- summarize about different software problems and solutions.
- outline the about protection in Social media.
- discuss the need of protecting reputation.

TEXT BOOKS

1. Sammons, John, and Michael Cross. The Basics of Cyber Safety: Computer and Mobile Device Safety Made Easy. Elsevier, 2016.
2. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cyber Security Essentials. John Wiley & Sons, 2018.

REFERENCES

1. Charles P. Pfleeger, Shari Lawrence, Pfleeger Jonathan Margulies; Security in Computing, Pearson Education Inc . 5th Edition, 2015.
2. Wheeler, D. A. Secure programming HOWTO, 2017.
3. Bishop, M. Computer Security: Art and Science. Pearson Education, Boston, US, 2003.
4. Nina Godbole, Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, Wiley, 2017.

CO/PO MAPPING :

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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CO3	3	2	3	2	2	2	2	-	1	2	-	2	2	2
CO4	2	2	3	2	1	1	2	-	1	2	-	2	2	3
CO5	3	2	2	1	1	1	1	-	1	2	-	2	2	2

PRE-REQUISITE: Fundamentals of Computer Science

CY20951 AMCAT (ONLINE PLACEMENT APTITUDE CERTIFICATION) 0 0 2 1

COURSE OBJECTIVES

To enable students to

- understand the basics of OS, CA and DBMS.
- understand the basics of networking and protocols.

COURSE LAYOUT

Operating System and Computer Architecture - Basics of OS and Computer Architecture, Process Management and Synchronization and Memory and I/O Management. DBMS - Data model, Relational Algebra and SQL, Normalization, Architecture, and Indexing. **Computer Networks** - Basics of networking and communication, OSI, TCP/IP layers and protocols and Network Devices and Routing Algorithms.

TOTAL PERIODS 30

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- know and deploy the basic techniques in OS, CA and DBMS.
- design database with networking and communication.

TEXT BOOKS

1. Silberschatz, Galvin, and Gagne, "Operating System Concepts", Ninth Edition, Wiley India Pvt Ltd, 2013.
2. Thomas Connolly and Carolyn Begg, —Database Systems: A Practical Approach to Design,

   Implementation and Management, Fifth Edition, Pearson Education, 2009.
3. William Stallings, —Data and Computer Communications, Tenth Edition, Pearson Education, 2013.

WEB LINK

1. https://www.myamcat.com/courses

PREREQUISITE: Basics of Mathematical Concept

CY20952 eLITMUS (ONLINE PLACEMENT APTITUDE CERTIFICATION) 0 0 2 1

COURSE OBJECTIVES

To enable students to

- understand the importance of sections like numerical ability and reasoning ability.
- abilitizverbal usage.

COURSE LAYOUT

eLitmus Syllabus for Quantitative Aptitude- Number Systems - Coordinate Geometry – Logarithms - Quadratic Equations - Time, Speed and Distance – Geometry - Permutation and Combination. Logical Reasoning - Data Tabulation based Questions - Arrangement Based Problems - crypt arithmetic Problem - Bar Graphs/Pie Charts. Verbal Ability - Questions Related To Grammatical Concepts - Reading Comprehension - Paragraph Based Questions.

TOTAL PERIODS 30

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- solve problems on quantitative aptitude.
- solve verbal questionnaire.

TEXT BOOK

1. Crypt arithmetic Division Problems, "A Complete Guide for eLitmus Exam".

WEB LINK

1. http://www.elitmuszone.com/elitmus/cryptarithmetic-division-problems/

PREREQUISITE: Basics of Mathematical concepts and computer science

CY20953	NASSCOM NAC-TECH (ONLINE PLACEMENT APTITUDE CERTIFICATION)	0 0 2 1

COURSE OBJECTIVES

To enable students to

- understand the quantitative sections and enable problem solving.
- improve the technical knowledge in subjects related to Computer Science Engineering.

COURSE LAYOUT

Verbal ability - Articles, reading comprehension, prepositions, and synonyms - Analytical Ability: Data sufficiency, series and pattern completion, conceptualization, Venn diagram, puzzles Programming Fundamentals -SDLC, Algorithm, flowcharts.5.Learning Ability Test: Learning abilities. Written English Test - Introduction to Databases, Relationships, ER Diagrams, Constraints and Keys, Normalization, Indexing, Performance, Locking, Database Structures and Processes, Process Management, Deadlocks, Memory management, OS File Management, OS Security fundamentals, IO Management, Device Management, Network Technology, Network Topology, OSI Reference model, Protocols, Client Server Architecture, Linked Lists, Trees, Stacks, Queues, Dynamic Memory Allocation, Sorting and Searching Algorithms, Structures, Software Life Cycle(SDLC), Requirements Analysis, Design, Coding, Levels of Testing, Implementation, Maintenance, Development Models

TOTAL PERIODS 30

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- solve problems from numerical, reasoning and verbal ability.
- deal with the basics of all technical topics included.

TEXT BOOK

1. "Strategic Alliance between NASSCOM and NIIT focusing on skill development", NIIT.

WEB LINK

1. http://nactech.nasscom.in/

PRE REQUISITE: Basics of Mathematical Concept

CY20954 I-PAT (ONLINE PLACEMENT APTITUDE CERTIFICATION) 0 0 2 1

COURSE OBJECTIVES

To enable students to

- understand the numerical ability problems on series.
- understand topics like geometry, SI and CI, probability.

COURSE LAYOUT

Numeric Series Problem - Difference based Series - Common Rule Series - Pair Wise Series - Interleaved Series - Power based Series - Exotic Series. Math Word Problems - Ratios and Percentages - Work and Time - Ipat Geometry - Mixtures and Compounds - Interest and Probability.

TOTAL PERIODS 30

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- solve numerical ability problems on number series.
- solve problems on the topic geometry, work and time, percentage, SI CI, probability.

TEXT BOOK

1. IBM IPAT, "JobTestPrep".

WEB LINK

1. https://masteribmipat.com.

PREREQUISITE: Database Management Systems

CY20957 **ORACLE- SQL FUNDAMENTALS** **0 0 2 1**

COURSE OBJECTIVES

To enable students to

- Acquire knowledge about database and query creations.
- understand the DDL statement and manage the tables.

COURSE LAYOUT

Retrieving Data using the SQL SELECT Statement - Restricting and Sorting Data - Using Single-Row Functions to Customize Output - Using Conversion Functions and Conditional Expressions - Reporting Aggregated Data Using the Group Functions - Displaying Data From Multiple Tables - Using Subqueries to Solve Queries - Using the SET Operators - Manipulating Data - Using DDL Statements to Create and Manage Tables - Creating Other Schema Objects.

TOTAL PERIODS 30

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- gain knowledge about database and query creations
- understand the statements to create and manage tables.

TEXT BOOK

1. John J.Patrick, "SQL Fundamentals", Third edition 2010.

WEB LINK:

1. http://www.oraclestudy.com/oracle-1z0-051-certification-exam-syllabus

PRE REQUISITE: Java programming

CY20958 **ORACLE – JAVA FUNDAMENTALS** **0 0 2 1**

COURSE OBJECTIVES

To enable students to

- Acquire knowledge on different problem solving techniques.
- Demonstrate data persistency using files.

COURSE LAYOUT

JAVA-History and philosophy of Java-Understand Java's contribution to the Internet-Understand the importance of byte code- Know the Java buzzwords-Understand the foundational principles of object-oriented programming-Use variables, Use the if and for -control statements-Create blocks of code - Know the java keywords-Understand the rules for Java identifiers-Create, compile, and run a simple Java program. **ORACLE-** Database design using SQL-Basic SQL syntax and the rules for constructing valid SQL statements -design, implement, and demonstrate a database solution for a business or organization.

TOTAL PERIODS 30

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- gain knowledge about different Problem solving techniques.
- understand basic concepts of java programs.

TEXT BOOKS

1. Herbert Schildt, "Java The Complete Reference", 8th Edition, McGraw - Hill Osborne Media, 2011.
2. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education, 2006.

WEB LINK

1. https://education.oracle.com/pls/web_prod-plq

PREREQUISITE: Networking

CY20959	**CCNA – CISCO CERTIFIED NETWORK ASSOCIATE**	**0 0 2 1**

COURSE OBJECTIVES

To enable students to

- understand the basics of networking.
- understand the concepts in network management.

COURSE LAYOUT

Introduction – Network works – Purpose and functions of network devices – components – TCP/IP models – Voice Over IP and Video Over IP – network and Internet Communication – LAN/WAN operation and features – Troubleshoot switch with VLANs – Interswitch communication – Ethernet networks – Traffic management – Cisco switches – Ping – traceroute – telnet – SSH. Switiching Technologies- VIP, RSTP, VLAN, PVSTP. Benefits of private and public IP addressing. Basic router operation – Routing on Cisco devices – Implementation of WAN links.

TOTAL PERIODS 30

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- know the basics of networking.
- explain the concepts involved in bridging.

TEXT BOOK

1. Cisco 7304 Network Service Engine Installation and Configuration
2. CCNA™: Cisco® Certified Network Associate Study Guide, 5th Edition

WEB LINK

1. http://study-ccna.com/

PREREQUISITE: Java Programming.

CY20960 SCJP / OCPJP -SUN CERTIFIED JAVA PROGRAMMER / ORACLE CERTIFIED PROFESSIONAL JAVA PROGRAMMER **0 0 2 1**

COURSE OBJECTIVES

To enable students to

- apply data types and various utility classes in java programs
- understand the manipulate data and exception.

COURSE LAYOUT

Java Basics - scope of variables - Working with Java Data Types - Using Operators and Decision Constructs - Creating and Using Arrays - Using Loop Constructs - Working with Methods and Encapsulation - Working with Inheritance - Handling Exceptions - Working with Selected classes from the Java API - Manipulate data using the String Builder - unchecked exceptions, and Errors - try-catch block - features and components of Java.

TOTAL PERIODS 30

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- create applications using inheritance, packages and interfaces.
- work with string and API framework.

TEXT BOOK

1. Kathy Sierra, Bert Bates "SCJP Sun Certified Programmer for Java 6 Study Guide Books"

WEB LINK

1. http://ocjp.in/ocjp-syllabus/

PREREQUISITE: Nil

CY20961 **ANDROID APPLICATION DEVELOPMENT** **0 0 2 1**

COURSE OBJECTIVES

To enable students to

- Acquire knowledge on different android app life cycle and components.
- understand the debugging android development environment and play store.

COURSE LAYOUT

Android App life cycle and its main components - Create a graphical user interface (GUI) - Implement a custom application theme - Define a Recycler View item list - Implement menu-based or drawer navigation - Integrate code from an external support library - Schedule a time-sensitive task using alarms - Schedule a background task using Job Scheduler - Designing and building a functional Android application - Debugging Android applications using different tools and plugins - Setting up and understanding your Android Development Environment - Register and publishing on Play Store.

TOTAL PERIODS 30

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- understand about different android app life cycle and components.
- understand the debugging android development environment and play store.

TEXT BOOK

1. John Horton, "Android Programming for Beginners", Second Edition, 2011.

WEBLINK

1. https://www.udemy.com/learn-android-application-development-y/

PREREQUISITE: Nil

CY20962 **PC HARDWARE AND TROUBLESHOOTING** **0 0 2 1**

COURSE OBJECTIVES

To enable students to

- understand the concept of computer organization and device controllers.
- understand the virtual memory and LSI.

COURSE LAYOUT

Introduction - Computer Organization - Number Systems and Codes - Memory - ALU Instruction prefetch - Interrupts - I/O Techniques - Device Controllers - Error Detection Techniques - Microprocessor - Personal Computer Concepts - Advanced System Concepts - Microcomputer Concepts - OS - Multitasking and Multiprogramming - Virtual Memory - Cache Memory - Modern PC and User. Microprocessor and Firmware - Programmable LSI's - Bus Faults - Faults Elimination process - Systematic Troubleshooting - Symptoms observation and analysis - fault diagnosis - fault rectification - Troubleshooting levels.

TOTAL PERIODS 30

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- Develop and implement the concept of number system and codes.
- implement the microprocessor and firmware.

TEXT BOOKS

1. B. Govindarajalu, "IBM PC Clones Hardware, Troubleshooting and Maintenance", 2/E, TMH, 2002.

WEB LINK

1. http://www.learning-about-computers.com/tutorials/troubleshooting.sh

PREREQUISITE: Nil

CY20963 **E-COMMERCE SECURITY** **0 0 2 1**

COURSE OBJECTIVES

To enable students to

- to prepare student to understand current threats facing organizations that conduct business online.
- how to mitigate these challenges, to apply cryptography and related security techniques to e-commerce including secure electronic transactions, electronic payment systems

COURSE LAYOUT

The importance of e-commerce security to the business enterprise, Current threats facing organizations that conduct business online and how to mitigate these challenges, Cryptography review, public key certificates and infrastructures, authentication and authorization certificates, secure credential services and role-based authorization, mobile code security, security of agent-based systems, secure electronic transactions, electronic payment systems.

TOTAL PERIODS 30

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- to understand current threats facing organizations that conduct business online and how to mitigate these challenges
- to apply cryptography and related security techniques to e-commerce including secure electronic transactions, electronic payment systems, intellectual property protection, and issues on law and regulation.

TEXT BOOKS

1. Gary Schneider, Electronic Commerce, Sixth Edition, Course Technologies, 2006, ISBN: 0-619-21704-9

WEB LINK

http://csrc.nist.gov/publications/nistpubs/index.html

All Courses:

CY20955	-	NPTEL / Swayam (All Online courses)
CY20956	-	Spoken Tutorial (All Online courses)
CY20964	-	Coursera (All Online courses)
CY20965	-	Edx (All Online courses)
CY20966	-	Udemy (All Online courses)