

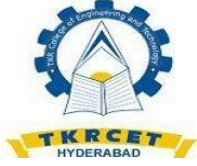


T K R COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING

B.Tech.VII Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1.	B57PE1	1. Big Data Analytics 2. Network Security 3. Mobile Computing	3	1	0	3
2.	B57PE2	1. Cloud Computing 2. WebServices 3. Computer Graphics	3	1	0	3
3.	B57PE4	1. Machine Learning 2. Computer Forensics 3. Internet of Things	3	1	0	3
4.	B57OE5	OPEN ELECTIVE	3	1	0	3
5.	B57PC6	Technologies Lab	0	0	3	1.5
6.	B57CV7	Comprehensive Test	0	0	6	3
7.	B58PW1	Project Part – A	0	0	8	4
Total Credits						20.5



T K R COLLEGE OF ENGINEERING & TECHNOLOGY (Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING – R18

Big Data Analytics - B57PE1

B.Tech.VIISemester

L/T/P/C

3/1/0/3

COURSE OBJECTIVE: Provide an overview of apache hadoop, HDFS concepts and interfacing, eco system, apply analytics on structured and unstructured data.

COURSE OUTCOMES:

After completion of this course, students will be able to

1. Analyze data management in various sources. L4
2. Use the big data tools for decision making. L3
3. Compute descriptive statistics to understand the nature of the data. L3
4. Design Machine Learning Algorithms for prediction. L5
5. Use appropriate tools for data visualization. L3

Unit – I:

Data Management (NOS 2101): Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signal/GPS etc. Data Management, Data Quality (noise, outliers, missing values, duplicate data) and Data Preprocessing.

Export all the data onto Cloud ex. AWS/Rackspace etc.

Maintain Healthy, Secure Working Environment (NOS 9003): Introduction, workplace safety, Report Accidents & Emergencies, Protect health & safety as your work, course conclusion, and assessment.

Unit – II:

Big Data Tools (NOS 2101): Introduction to Big Data tools like Hadoop, Sparta, Impala etc., Data ETL process, Identify gaps in the data and follow-up for decision making

Provide Data/information In Standard Formats (NOS 9004): Introduction, Knowledge Management, and Standardized reporting & compliances, Decision Models, course conclusion. Assessment.

Unit – III:

Big Data Analytics: Run descriptive to understand the nature of the available data, collate all the data sources to suffice business requirement, Run descriptive statistics for all the variables and observe the data ranges, Outlier detection and elimination.

Unit – IV:

Machine Learning Algorithms (NOS 9003): Hypothesis testing and determining the multiple analytical methodologies, Train Model on 2/3 sample data using various Statistical/Machine learning algorithms, Test model on 1/3 sample for prediction etc.

Unit – V:

(NOS 9004) Data Visualization (NOS 2101): Prepare the data for Visualization, Use tools like Tableau, Click View and 03, Draw insights out of Visualization tool.

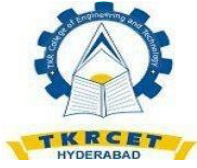
TEXT BOOK

Student's Handbook for Associate Analytics

REFERENCE BOOKS

Introduction to Data Mining, Tan, Steinbach and Kumar, Addison Wesley, 2006

1. Data Mining Analysis and Concepts, M Zaki and W.Meira (the authors have kindly made an online version available).
2. <http://www.dataminingbook.infoluploads/books.pdf>
3. Mining of Massive Datasets Jure Leskovec Stanford Univ. Anand Rajaraman Millliway Labs Jeffrey D. Ullman StanfordUniv.
4. (http://www.vistrails.org/index.php/course:_Big_Data_Analysis)



T K R COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING
NETWORK SECURITY (B57PE1)-R18

B.Tech.VII Semester

L/T/P/C
3/1/0/3

COURSE OBJECTIVE:

Analyze various security mechanisms in transport layer security, wireless network security, types of intruders, malicious softwares, viruses, firewalls, legal and ethical issues in network security.

COURSE OUTCOMES:

After completion of course the student will be able to

1. Analyze various security mechanisms in transport layer security. L4
2. Compare and contrast security mechanisms in wireless network security. L4
3. Analyze different types of intruders, malicious softwares, viruses.L4
4. Analyze various types of firewalls. L4
5. Learn network management security, legal and ethical aspects. L1

Unit – I:

Transport-Level Security

Web Security Considerations, Secure Socket Layer and Transport Layer Security, Transport Layer Security, HTTPS, Secure Shell (SSH).

Unit – II:

Wireless Network Security: IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security, Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP End-to-End Security.

Unit – III:

Intruders: Introduction, Intrusion Detection, Password, the Base-Rate Fallacy Malicious Software

Types of Malicious Software, Viruses, Virus Countermeasures, Worms, Distributed Denial of Service Attacks

Unit – IV:

Firewalls

The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations.

Unit – V:

Network Management Security

Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3

Legal and Ethical Aspects

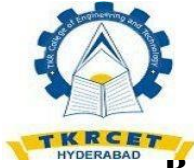
Cybercrime and Computer Crime, Intellectual Property, Privacy, Ethical Issues.

TEXT BOOK

Network Security Essentials by William Stallings, Fourth Edition-Pearson Education.

REFERENCE BOOKS

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addison Wesley, 2006
2. Applied Cryptography by Bruce Schneier-John Wiley & Sons.
3. Corporate Computer and Network Security by Raymond Panko-Pearson Education.
4. Security in Computing by Charles P. Pfleeger-O'Reilly Publications.



T K R COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING – R18

MOBILE COMPUTING - B57PE1

B.Tech.VIISemester

L/T/P/C
3/1/0/3

COURSE OBJECTIVES:

Illustrate various MAC protocols, telecommunication taxonomy, protocols in network, transport, application layers and mobile application designs.

COURSE OUTCOMES:

After completion of course the student will be able to

1. Understand mobile computing and analyze various MAC protocols L4
2. Illustrate the taxonomy of telecommunication systems in wireless networks. L3
3. Analyze various protocols in mobile network layer. L4
4. Illustrate various protocols related to mobile transport and application layer. L3
5. Develop a mobile application using android/blackberry/iOS/Windows SDK. L5

Unit – I:

INTRODUCTION : Introduction to Mobile Computing – Applications and characteristics of Mobile Computing-Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA-CDMA.

Unit – II:

MOBILE TELECOMMUNICATION SYSTEM: Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS-UMTS – Architecture – Handover – Security.

Unit – III:

MOBILE NETWORK LAYER : Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.

Unit – IV:

MOBILE TRANSPORT AND APPLICATION LAYER : Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML.

Unit – V:

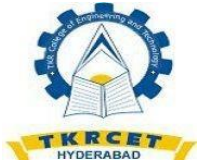
MOBILE PLATFORMS AND APPLICATIONS : Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

TEXT BOOK

1. Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing, PHI Learning Pvt.Ltd, New Delhi – 2012

REFERENCE BOOKS

1. Dharma Prakash Agarwal, Qing and An Zeng, “Introduction to Wireless and Mobile systems”, Thomson Asia Pvt Ltd,2005.
2. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, —Principlesof Mobile Computing, Springer, 2003.
3. William.C.Y.Lee,—Mobile Cellular Telecommunications-Analog and Digital Systems, Second Edition,TataMcGraw Hill Edition,2006.
4. C.K.Toh, —AdHocMobile Wireless Networks, First Edition, Pearson Education,2002.
5. Android Developers :<http://developer.android.com/index.html>
6. Apple Developer :<https://developer.apple.com/>
7. Windows Phone DevCenter :<http://developer.windowsphone.com>
8. BlackBerry Developer :<http://developer.blackberry.com>



T K R COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING -R18

CLOUD COMPUTING -B57PE2

B.Tech VII Semester

L/T/P/C

3/1/0/3

COURSE OBJECTIVE:

Analyze the concepts of cloud computing, services, security core issues, various applications and access control mechanisms.

COURSE OUTCOMES:

After completion of course the student will be able to

1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing. L2
2. Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc. L2
3. Explain the core issues of cloud computing such as security, privacy, and interoperability. L3
4. Provide the appropriate cloud computing solutions and recommendations according to the applications used. L3
5. Analyze various access control mechanisms in cloud. L5

Unit – I:

History of Centralized and Distributed Computing - Overview of Distributed Computing, Cluster computing, Grid computing. Technologies for Network based systems- System models for Distributed and cloud computing- Software environments for distributed systems and clouds.

Unit – II:

Introduction to Cloud Computing- Cloud issues and challenges - Properties - Characteristics - Service models, Deployment models. Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage. Virtualization concepts - Types of Virtualization- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs.

Unit – III:

Service models - Infrastructure as a Service (IaaS) - Resource Virtualization: Server, Storage, Network - Case studies. Platform as a Service (PaaS) - Cloud platform & Management: Computation, Storage - Case studies. Software as a Service (SaaS) - Web services - Web 2.0 - Web OS - Case studies – Anything as a service (XaaS).

Unit – IV:

Cloud Programming and Software Environments – Parallel and Distributed Programming paradigms – Programming on Amazon AWS and Microsoft Azure – Programming support of Google App Engine – Emerging Cloud software Environment.

Unit – V:

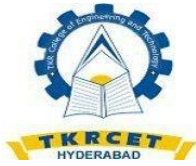
Cloud Access: authentication, authorization and accounting - Cloud Provenance and meta-data - Cloud Reliability and fault-tolerance - Cloud Security, privacy, policy and compliance- Cloud federation, interoperability and standards.

TEXT BOOK

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, “Distributed and cloud computing from Parallel Processing to the Internet of Things”, Morgan Kaufmann, Elsevier – 2012.

REFERENCE BOOKS

1. Barrie Sosinsky, “Cloud Computing Bible” John Wiley & Sons,2010.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy an Enterprise Perspective on Risks and Compliance, O'Reilly2009.



TKRC COLLEGE OF ENGINEERING & TECHNOLOGY (Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING-R18

WEB SERVICES -B57PE2

B.Tech VII Semester

L/T/P/C

3/1/0/3

COURSE OBJECTIVE:

Understand the details of web services technologies like WSDL, UDDI, SOAP, implement and deploy web service client and server and interoperability between different frameworks.

COURSE OUTCOMES:

After completion of course the student will be able to

1. Learn evolution and emergence of web services. L2
2. Explain about the Fundamentals of SOAP. L2
3. Generalize web service life cycle. L2.
4. Analyze various discovery mechanisms and limitation of UDDI. L4
5. Create a Java client for Web service interoperability. L5

UNIT – I:

Evolution and Emergence of Web Services - emergence of Web Services and Service Oriented Architecture (SOA). Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services. Web Services Architecture – Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication models, basic steps of implementing web services.

UNIT – II:

Fundamentals of SOAP – SOAP Message Structure, SOAP encoding, Encoding of different data types, SOAP message exchange models, SOAP communication and messaging, Java and Axis, limitations of SOAP.

UNIT – III:

Describing Web Services – WSDL – WSDL in the world of Web Services, Web Services life cycle, anatomy of WSDL definition document, WSDL bindings, WSDL Tools, limitations of WSDL

UNIT – IV:

Discovering Web Services – Service discovery, role of service discovery in a SOA, service discovery mechanisms, UDDI – UDDI registries, uses of UDDI Registry, Programming with UDDI, UDDI data structures, Publishing API, Publishing, searching and deleting information in a UDDI Registry, limitations of UDDI.

UNIT – V:

Web Services Interoperability – Means of ensuring Interoperability, Overview of .NET, Creating a .NET client for an Axis Web Service, creating Java client for a Web service, Challenges in Web Services Interoperability. Web Services Security – XML security frame work, Goals of Cryptography, Digital signature, Digital Certificate, XML Encryption.

TEXT BOOK

1. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India

REFERENCE BOOKS

1. Java Web Service Architecture, James McGovern, Sameer Tyagi et al.,Elsevier
2. Building Web Services with Java, 2nd Edition, S. Graham and others, PearsonEdn.
3. Java Web Services, D.A. Chappell & T. Jewell,O'Reilly,SPD.
4. Web Services, G. Alonso, F. Casati and others,Springer.



T K R COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING-R18

COMPUTER GRAPHICS -B57PE2

B.TechVII Semester

L/T/P/C

3/1/0/3

COURSE OBJECTIVES:

To learn and make understand about fundamentals of Graphics to construct design animated scenes for virtual object creations, present the content graphically.

COURSE OUTCOMES:

After completion of course, students will be able to

1. Understand fundamentals of computer graphics and various output primitives. L2
2. Demonstrate the concepts of 2D Geometrical transforms and viewing. L2
3. Compare Hermite curve, Bezier curve and B-spline curves. L4
4. Analyze surface detection and Surface rendering Methods. L4
5. Design animation sequence. L5

UNIT – I:

Introduction: Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices Output primitives: Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood fill algorithms.

UNIT – II:

2-D Geometrical Transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems. 2-D Viewing: The viewing pipeline, viewing coordinate reference frame, window to viewport coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

UNIT – III:

3-D Object Representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-spline curves, Bezier and B-spline surfaces, sweep representations, octrees BSP Trees, 3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations, 3-D viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

UNIT – IV:

Visible surface detection methods: Classification, back-face detection, depth-buffer, scanline, depth sorting, BSP-tree methods, area sub-division and octree methods Illumination Models and Surface rendering Methods: Basic illumination models, polygon rendering methods.

UNIT – V:

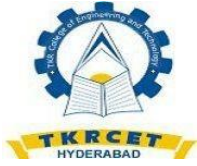
Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications

TEXT BOOK

1. “Computer Graphics C version”, Donald Hearn and M. Pauline Baker, Pearson Education.
2. “Computer Graphics Second edition”, Zhigandxiang, Roy Plastock, Schaum’s outlines, Tata Mc Graw hill edition.

REFERENCE BOOKS

1. “Computer Graphics Principles & practice”, second edition in C, Foley, Van Dam, Feiner and Hughes, Pearson Education.
2. “Procedural elements for Computer Graphics”, David F Rogers, Tata Mc Grawhill, 2nd edition.
3. “Principles of Interactive Computer Graphics”, Neuman and Sproul, TMH.
4. “Principles of Computer Graphics”, Shalini, Govil-Pai, Springer.
5. “Computer Graphics”, Steven Harrington, TMH
6. Computer Graphics, F. S. Hill, S. M. Kelley, PHI.
7. Computer Graphics, P. Shirley, Steve Marschner & Others, Cengage Learning.
8. Computer Graphics & Animation, M. C. Trivedi, Jaico Publishing House.
9. An Integrated Introduction to Computer Graphics and Geometric Modelling, R. Goldman, CRC Press, Taylor & Francis Group.
10. Computer Graphics, Rajesh K. Maurya, Wiley India.



T K R COLLEGE OF ENGINEERING & TECHNOLOGY (Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING -R18

MACHINE LEARNING -B57PE4

B.Tech VII Semester

L/T/P/C
3/1/0/3

COURSE OBJECTIVE

To be able to formulate machine learning problems corresponding to different applications and range of machine learning algorithms along with their strengths and weaknesses.

COURSE OUTCOMES:

After completion of course the student will be able to

1. Illustrate the concepts of concept learning. L2
2. Apply decision trees learning, artificial neural networks and evaluation hypotheses for the machine learning problems. L3
3. Develop Bayesian and support vector classifiers by removing irregular features and avoiding overfitting. L5
4. compare and contrast Instance-based learning techniques. –L4
5. Analyze genetic algorithms and dimensionality reduction techniques –L4

UNIT – I:

Introduction: An illustrative learning task, and a few approaches to it. What is known from algorithms? Theory, Experiment. Biology. Psychology. Overview of Machine learning, related areas and applications. Linear Regression, Multiple Regression, Logistic Regression, logistic functions.

Concept learning: Version spaces. Inductive Bias. Active queries. Mistake bound/ PAC model basic results. Overview of issues regarding data sources, success criteria.

UNIT – II:

Decision Tree Learning: Minimum Description Length Principle. Occam's razor. Learning with active queries Introduction to information theory, Decision Trees, Cross Validation and over fitting. Neural Network Learning: Perceptions and gradient descent back propagation, multilayer networks and back propagation.

UNIT – III:

Sample complexity and over fitting: Errors in estimating means. Cross Validation and jackknifing vc dimension.

Irrelevant Features: Multiplicative rules for weight tuning.

Support Vector Machines: functional and geometric margins, optimum margin classifier, constrained optimization, Lagrange multipliers, primal/dual problems, KKT conditions, dual of the optimum margin classifier, soft margins, and kernels.

Bayesian Approaches: The basics Expectation Maximization. Bayes theorem, Naive Bayes Classifier, Markov models, Hidden Markov Models.

UNIT – IV:

Instance-based Techniques: Lazy vs. eager generalization. K nearest neighbor, case- based reasoning. Clustering and Unsupervised Learning: K-means clustering, Gaussian mixture density estimation, model selection.

UNIT – V:

Genetic Algorithms: Different search methods for induction - Explanation-based Learning:using prior knowledge to reduce samplecomplexity.

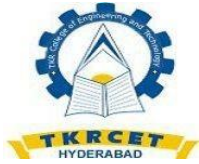
Dimensionality Reduction: feature selection, principal component analysis, linear discriminant analysis, factor analysis, independent component analysis, multidimensional scaling, manifold learning

TEXT BOOK

1. Tom Michel, Machine Learning, McGraw Hill,1997.
2. Trevor Hastie, Robert Tibshirani& Jerome Friedman. The Elements of Statistical Learning, Springer Verlag,2001.

REFERENCE BOOKS

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge UnivPress.
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc.,2001.
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press,1995.



T K R COLLEGE OF ENGINEERING & TECHNOLOGY (Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING -R18

COMPUTER FORENSICS -B57PE4

B.TechVII Semester

L/T/P/C
3/1/0/3

COURSE OBJECTIVES:

Analyze and collect the digital evidences against crime.

COURSE OUTCOMES:

After completion of course the student will be able to

1. Understand Fundamentals of Computer Forensics. L2
2. Illustrate Evidence collection and Data seizure. L2
3. Processing crime and incident scenes using computer forensic analysis and validation. L3
4. compare and contrast different computer forensic tools, cellphone and mobile device forensics. L4
5. Explain whole disk encryption, windows registry and Microsoft startup tasks. L2

UNIT – I:

Computer Forensics Fundamentals: What is Computer Forensics?, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement — Computer Forensic Technology — Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined — Data Back-up and Recovery — The Role of Back-up in Data Recovery — The Data-Recovery Solution.

UNIT – II:

Evidence collection and Data seizure: Why Collect Evidence? Collection Options — Obstacles — Types of Evidence — The Rules of Evidence — Volatile Evidence — General Procedure — Collection and Archiving — Methods of Collection — Artifacts — Collection Steps — Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital

Evidence: Preserving the Digital Crime Scene — Computer Evidence Processing Steps Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication — Practical Consideration — Practical Implementation.

UNIT – III:

Computer forensics analysis and validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, and performing remote acquisitions
Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project. Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case.

UNIT – IV:

Current Computer Forensic Tools: evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software
E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

Cellphone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

UNIT – V:

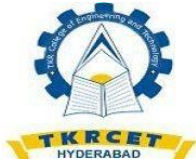
Working With Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

TEXT BOOKS

1. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
2. Computer Forensics and Investigations by Nelson, Phillips Enfinger, Stuart, CENGAGE Learning

REFERENCE BOOKS

1. Real Digital Forensics by Keith J. Jones, Richard Bejtlich, Curtis W. Rose, Addison- Wesley Pearson Education.
2. Forensic Compiling, A Tractitioner's Guide by Tony Sammes and Brian Jenkinson, Springer International edition.
3. Computer Evidence Collection & Presentation by Christopher L.T. Brown, Firewall Media.
4. Homeland Security, Techniques & Technologies by Jesus Mena, Firewall Media.
5. Software Forensics Collecting Evidence from the Scene of a Digital Crime by Robert M. Slade, TMH 2005.
6. Windows Forensics by Chad Steel, Wiley India.



TKR COLLEGE OF ENGINEERING & TECHNOLOGY (Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING -R18

INTERNET OF THINGS -B57PE4

B.Tech VII Semester

L/T/P/C
3/1/0/3

COURSE OBJECTIVE: Learn the concepts of IOT and build simple IOT Systems

COURSE OUTCOME:

After completion of course the student will be able to

- 1 Construct the IoT Logical design architecture with core functional stack.L3
- 2 Compare and contrast between IoT and M2M. L4
- 3 Design hardware and software for IoT using IoT design methodology and hon packages. L5
- 4 Explain the detailed features of IoT devices, Board and Interfaces.L2
- 5 Illustrate IoT design for a given application.L3

UNIT – I:

Introduction to Internet of Things: Introduction, physical design of IoT, logical design of IoT-functional blocks, communicational models, communication APIs, IoT enabling technologies, IOT levels & deployment templates.

UNIT – II:

IoT and M2M: Introduction, M2M, Difference between IoT and M2M ,SDN and NFV for IoT, IoT System Management with NETCONF-YANG: Need for IOT systems management, simple network management protocol, network operator requirements, NETCONF, YANG, IoT system management with NETCONF-YANG.

UNIT – III:

IoT Platforms Design Methodology: Introduction, IoT Design Methodology, Motivation for Python

Hardware and Software for IoT: Logical design using Python-data types & Data Structures, control flow, functions, modules, packages, file handling, classes, Python packages of Interest for IoT.

UNIT – IV:

IoT Physical Devices & Endpoints: IoT Device, Exemplary Device Raspberry Pi, Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with python.

UNIT – V:

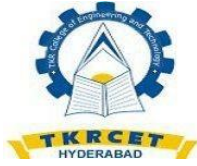
IoT Physical Servers & Cloud Offerings: Introduction to Cloud Storage Models Communication APIs. WAMP- Auto Bahn for IoT, Xively Cloud for IoT, Python Web Application Framework – Django .Case Studies Illustration IoT Design: Introduction, Home Automation, Cities.

TEXT BOOKS

1. ArshdeepBahga, Vijay Madiseti, —Internet of Things – A hands-on approach, Universities Press,2015.

REFERENCE BOOKS

1. Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press,2017.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit2).
3. Jan Ho" ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Aves and. David Boyle, "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Elsevier,2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internetof Things, Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media,2011.



TKR COLLEGE OF ENGINEERING & TECHNOLOGY (Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING - R18

TECHNOLOGIES LAB -B57PC6

B.Tech. VII Semester

L/T/P/C
0/0/3/1.5

MACHINE LEARNING LABORATORY

COURSE OBJECTIVE:

To disseminate the practical demonstration the concepts of machine learning and Internet of things.

COURSE OUTCOMES:

After completion of this course will enable students to

1. Make use of Data sets in implementing the machine learning algorithms. L3
2. Apply the machine learning concepts and algorithms in any suitable language of choice. L3

Note:The programs can be implemented in either JAVA orPython.

1. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs ofJava/Python.
2. Data sets can be taken from standard repositories (<https://archive.ics.uci.edu/ml/datasets.html>) or constructed by thestudents.

Programs:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesisbased on a given set of training data samples. Read the training data from a CSVfile.
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 trainingexamples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Usean 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 Back propagation algorithm and testthe same using appropriate datasets.
5. Write a program to implement the naïve Bayesian classifier for a sample training dataset stored as a .CSV file. Compute the accuracy of the classifier, considering few test datasets.
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 dataset.
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 canuse Java/Python ML libraryclasses/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 ofthese two algorithms and comment on the quality of clustering. You can add Java/Python ML libraryclasses/API in the program.

9. Write a program to implement k-Nearest Neighbour 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.

INTERNET OF THINGS LAB

COURSE OUTCOMES:

After completion of the course Student will be able to

1. Develop the programs in python. L5
2. Gain knowledge of Arduino IDE and different types of Arduino Board Write program using Arduino IDE for Blink LED. L1
3. Develop programs using Arduino IDE and Arduino Board for RGB Led, RFID, NFC, MQTT Protocol and LED blinking using Raspberry Pi. L5

List of Programs

1. Study and Install Python in Eclipse and WAP for data types in python.
2. Write a Program for arithmetic operation in Python.
3. Write a Program for looping statement in Python.
4. Study and Install IDE of Arduino and different types of Arduino.
5. Write program using Arduino IDE for Blink LED.
6. Write Program for RGB LED using Arduino.
7. Study the Temperature sensor and Write Program for monitor temperature using Arduino.
8. Study and Implement RFID, NFC using Arduino.
9. Study and implement MQTT protocol using Arduino.
10. Study and Configure Raspberry Pi.
11. WAP for LED blink using Raspberry Pi.
12. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.



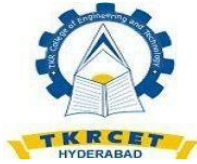
T K R COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING

COURSE STRUCTURE FOR R 18 REGULATION

B.Tech.VIII Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1.	B58PE1	1. Predictive Analytics 2. Design Patterns 3. Adhoc Wireless Networks	3	1	0	3
2.	B58PE2	1. Software Testing Methodologies 2. Operation Research 3. Storage Area Networks	3	1	0	3
3.	B580E3	OPEN ELECTIVE	3	1	0	3
4.	B58PW4	Project Work Part – B	0	0	16	8
Total Credits						17



TKR COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING –R18

PREDICTIVE ANALYTICS - B58PE1

B.Tech.VIIISemester

L/T/P/C

3/1/0/3

COURSE OBJECTIVE:

Understand principles involved in analyzing the predictive behavior for business activities.

COURSE OUTCOMES: After completion of the course, students will be able to

1. Describe the terminology of predictive analytics frame work and its Applications. –L2
2. Apply Logistic regression techniques.L3
3. Implement objective segmentation for performing prediction tasks for business needs. –L3
4. Apply time series methods for analyzing and predicting the business needs. – L3
5. Implement standard process for working with documents. – L3

UNIT – I:

Introduction to Predictive Analytics & Linear Regression : What and Why Analytics, Introduction to Tools and Environment, Application of Modelling in Business, Databases & Types of data and variables, Data Modelling Techniques, Missing imputations etc. Need for Business Modelling. Regression — Concepts, Blue property-assumptions-Least Square Estimation. Variable Rationalization, and Model Building etc.

UNIT – II:

Logistic Regression: Model Theory, Model fit Statistics, Model Conclusion, Analytics applications to various Business Domains etc. Regression Vs Segmentation — Supervised and Unsupervised Learning, Tree Building — Regression, Classification, Overfitting, Pruning and complexity. Multiple Decision Trees etc.

UNIT – III:

Objective Segmentation: Regression Vs Segmentation — Supervised and Unsupervised Learning, Tree Building — Regression, Classification, Overfitting, Pruning and complexity, Multiple Decision Trees etc. Develop Knowledge, Skill and Competences (NOS 9005) Introduction to Knowledge skills & competences, Training & Development, Learning & Development, Policies and Record keeping, etc.

UNIT – IV:

Time Series Methods Forecasting, Feature Extraction: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average, Energy etc and Analyze for prediction. Project

UNIT – V:

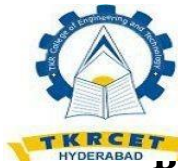
Working with Documents: Standard Operating Procedures for documentation and knowledge sharing. Defining purpose and scope documents, Understanding structure of documents — case studies, articles, white papers, technical reports, minutes of meeting etc., Style and format, Intellectual Property and Copyright, Document preparation tools — Visio, PowerPoint, Word, Excel etc., Version Control, Accessing and updating corporate knowledge base. Peer review and feedback.

TEXT BOOK

1. Student's Handbook for Associate Analytics-III.

REFERENCE BOOK

1. Gareth James • Daniela Witten • Trevor Hastie Robert Tibshirani. An Introduction to Statistical Learning with Applications in R.
2. For more information about all JNTU updates please stay connected to us on FB and don't hesitate to ask any questions in the comment.



TKR COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING – R18

DESIGN PATTERNS - B58PE1

B.Tech.VIII Semester

L/T/P/C

3/1/0/3

COURSE OBJECTIVE:

Analyze the various patterns for software applications.

COURSE OUTCOMES:

After completion of the course the student will be able to

1. Explain about Design Pattern. L2
2. Design a document with all patterns for a given task.L5
3. Demonstrate structural pattern. L3
4. Analyze behavioral pattern. L4
5. Design a document with advanced behavioral patterns. L5

UNIT – I:

Introduction: What is a Design Pattern? Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design patterns, Organizing the Catalog, How Design patterns solve Design problems, How to select a Design Pattern, How to use a Design Pattern.

UNIT – II:

A Case Study: Designing a Document Editor, Design Problems, Document Structure, Formatting Embellishing the User Interface, Supporting Multiple Look and Feel Standards, Supporting Multiple Window systems, User Operations Spelling Checking and Hyphenation, Summary.

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

UNIT – III:

Structural Pattern Part – I: Adaptor, Bridge and Composite.

Structural Pattern Part – II: Decorator, facade, flyweight, proxy.

UNIT – IV:

Behavior Patterns Part – I: Chain of Responsibility, Command, Interpreter, and Iterator.

Behavior Patterns Part – II: Mediator, Memento, Observer.

UNIT – V:

Behavior Patterns Part – II (cont'd) State, strategy, Template Method, Visitor, Discussion of Behavioral Patterns.

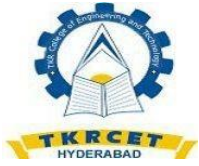
What to Expect from Design Patterns, A brief History, and the Pattern Community an Invitation, A Parting Thought.

TEXT BOOKS

1. Design Patterns by Erich Gamma, Pearson Education.

REFERENCE BOOK

1. Pattern's in JAVA Vol-I By Mark Grand, Wiley DreamTech.
2. Peeling Design Patterns, Prof MedaSrinivasa Rao, NarsimhaKarumanchi, CareerMonk Publication.
3. Design Patterns Explained By Alan Shallowy, PearsonEducation.
4. Pattern Oriented Software Architecture, af.Buschman& others, John Wiley & Sons.



T K R COLLEGE OF ENGINEERING & TECHNOLOGY

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B.TECH. COMPUTER SCIENCE & ENGINEERING – R18

AD HOC WIRELESS NETWORKS - B58PE1

B.Tech.VIII Semester

L/T/P/C

3/1/0/3

COURSE OBJECTIVE:

Analyze the issues and challenges, various MAC and routing protocols, challenges in the transport layer security and issues in designing security protocols for adhoc wireless sensor networks to QoS parameters.

COURSE OUTCOMES:

After completion of the course the student will be able to

1. List and explain the various issues and applications of Ad hoc wireless networks. L1
2. Classify and Explain the working of MAC protocols for Ad-hoc wireless networks. L2
3. Discuss the issues in designing routing protocols and working of Table-Driven Routing protocols.L2
4. Analyze the challenges in designing Transport layer Protocols for Ad-hoc networks, Compare and contrast the working of Transport protocols. L4
5. Identify the issues in designing Security Protocols for Ad-hoc networks focusing on the working performance of various security protocols. L2

UNIT – I:

Introduction: Cellular and Ad Hoc Wireless networks, Applications of Ad Hoc wireless networks; Issues in Ad hoc wireless networks: Medium access scheme, routing, multicasting, transport Layer Protocols, Pricing Scheme, Quality of service positioning, Self-organization, Security, Addressing and Service Discovery, Energy Management, Scalability, Deployment considerations.

UNIT – II:

MAC protocols: MAC Protocols for Ad hoc wireless Networks: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad-hoc wireless Networks, Classification of MAC Protocols, Contention based protocols with reservation mechanisms: D-PRMA, CATA, SRMA/PA, FPRP, HRMA

UNIT – III:

Routing Protocols: Routing protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks, Classification of Routing Protocols. Table driven routing Protocols: DSDV, WRP, On-Demand Routing Protocols: Dynamic source Routing Protocol DSR, AODV, TORA, LAR, ABR.

UNIT – IV:

TRANSPORT LAYER: Transport Layer Protocols for Ad-hoc wireless Networks: Introduction, Issues in Designing a Transport Layer Protocol for Ad-hoc wireless Networks, Design Goals of a Transport Layer Protocol for Adhoc wireless Networks, Classification of Transport Layer Solutions, TCP over Ad-hoc wireless Networks: Feedback-Based TCP, TCP with Explicit Failure Notification, TCP-BUS, Ad-hoc TCP, Split TCP.

UNIT – V:

Security: Security in wireless Ad hoc wireless Networks, Network security Requirements, Issues & Challenges in Security Provisioning, Network security Attacks, Key Management: Symmetric and Asymmetric key Algorithms, key Management Approaches, key management in Ad-hoc Wireless Networks: Secure routing in Ad hoc wireless Networks: Requirements, SAR protocol, Security-Aware AODV protocol.

TEXT BOOK

1. Ad hoc Wireless Networks– C. Siva Ram Murthy & B.S. Manoj, 2nd Edition, Pearson Education, 2005.

REFERENCE BOOKS

1. Ad hoc Wireless Networks – OzanK. Tonguz and Gianguigi Ferrari, JohnWiley,2006.
2. Ad hoc Wireless Networking – Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du,KluwerAcademic Publishers,2004.
3. Adhoc Mobile Wireless Networks - C.K. Toh, Protocols and Systems, Prentice-Hall PTR,200.



T K R COLLEGE OF ENGINEERING & TECHNOLOGY (Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING –R18

SOFTWARE TESTING METHODOLOGIES - B58PE2

B.Tech. VIII Semester

L/T/P/C

3/1/0/3

COURSE OBJECTIVE:

To learn the methodologies like flow graphs and path testing, transaction flow testing data flow testing, domain testing and logic base testing adapted in a Software Testing Process.

COURSE OUTCOMES:

After completion of the course the student will be able to

1. Understand the purpose of testing and taxonomy of bugs, explaining flow graphs and path testing process – L2
2. Explain the process involved in testing transaction flow and data flow scenarios – L2
3. Classify and compare domain testing – L2
4. Illustrate regular expression and flow anomaly detection –L3
5. Develop graph matrices and its applications –L4

UNIT – I:

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs.

Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT – II:

Transaction Flow Testing: transaction flows, transaction flow testing techniques.

Dataflow testing: Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.

UNIT – III:

Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT – IV:

Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing: overview, decision tables, path expressions.

UNIT – V:

State, State Graphs and Transition testing: state graphs, good & bad state graphs, statetesting, Testabilitytips.

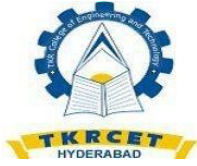
Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like JMeter or Win-runner).

TEXT BOOKS

1. Software Testing techniques – Boris Beizer, Dreamtech, second edition.
2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.

REFERENCE BOOKS

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing, 3rd edition, P.C. Jorgensen, Aurbach Publications (Dist. by SPD).
3. Software Testing, N. Chauhan, Oxford University Press.
4. Introduction to Software Testing, P. Ammann & J. Offutt, Cambridge Univ. Press.
5. Effective methods of Software Testing, Perry, John Wiley, 2nd Edition, 1999.
6. Software Testing Concepts and Tools, P. Nageswara Rao, dreamtech Press.
7. Software Testing, M. G. Limaye, TMH.
8. Software Testing, S. Desikan, G. Ramesh, Pearson.
9. Foundations of Software Testing, D. Graham & Others, Cengage Learning.
10. Foundations of Software Testing, A. P. Mathur.



T K R COLLEGE OF ENGINEERING & TECHNOLOGY
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B.TECH. COMPUTER SCIENCE & ENGINEERING – R18

OPERATION RESEARCH - B58PE2

B.Tech.VIIISemester

L/T/P/C

3/1/0/3

COURSE OBJECTIVES:

1. Understanding the mathematical importance of development of model in a particular optimization model for the issue and solving it.
2. Emphasize the mathematical procedures of nonlinear programming search techniques. Operation Research attempts to find the best or optimal solution to the problem under
3. Consideration, taking into account the goals of the organization.

COURSE OUTCOME:

Understanding the problem, identifying variables & constants, formulas of optimization model and applying appropriate optimization Tech.

UNIT – I:

Development – Definition - Characteristics and Phases – Types of models — Operations Research models – applications. Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method - Artificial variables techniques: Two-phase method. Big – M method.

UNIT – II:

Transportation Problem – Formulation – Optimal solution, unbalanced transportation problem — Degeneracy. Assignment problem — Formulation — Optimal solution – Variants of Assignment Problem- Travelling Salesman problem.

UNIT – III:

Sequencing – Introduction – Flow -Shop sequencing – n jobs through two machines — n job. Through three machines — Job shop sequencing — two jobs through ‘m machines.

UNIT – IV:

Theory of Games: Introduction -Terminology-. Solution of games with saddle points and without saddle points- 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

UNIT – V:

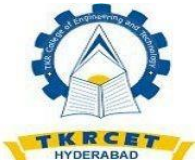
Waiting Lines: Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models- Multichannel – Poisson arrivals and exponential service times with infinite population.

TEXT BOOK

1. Operations Research / J.K ShaRma 4e/MacMilan
2. Introduction to O.R/Hillier &Libermann/TMH.

REFERENCE BOOKS

1. Introduction to O.R / Taha /PHI.
2. Operations Research! NVS Raju / SMS Education / 3rd RevisedEdition.
3. Operations Research / A.M.Natarejan / . P.Balasubramaniam. A. Tamilarasi Pearson Education.
4. Operation S Research I Wagner/ PillPublications.
5. Operations Research MA V. Durga Prasad. K. Vqaya Kumar Reddy. J. Suresh Kumar / Cengage Learning.



T K R COLLEGE OF ENGINEERING & TECHNOLOGY (Autonomous)

B.TECH. COMPUTER SCIENCE & ENGINEERING – R18

STORAGE AREA NETWORKS - B58PE2

B.Tech.VIIISemester

L/T/P/C

3/1/0/3

COURSE OBJECTIVE:

Demonstrate and understand the storage networks and their products, mechanisms for the backup or recovery.

COURSE OUTCOMES:

After completion of the course the student will be able to

1. Learn storage area networks characteristics and components, become familiar with SAN vendors And their products. –L2
2. Compare and contrast integrated and modular storage systems.L4
3. Analyze various planned and unplanned outages. L4
4. Discuss various recovery topologies. – L2
5. Identify and manage the key areas of data to store. L2

UNIT- I:

Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities Hardware and software components of the host environment, Key protocols and concepts used by each component ,Physical and logical components of a connectivity environment ,Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications.

UNIT- II:

Concept of RAID and its components , Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Compare and contrast integrated and modular storage systems ,High-level architecture and working of an intelligent storage system Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN , Benefits of the different networked storage options, Understand the need for long-term archiving solutions and describe how CAS fulfills the need , Understand the appropriateness of the different networked storage options for different application environments.

UNIT- III:

List reasons for planned/unplanned outages and the impact of downtime, Impact of downtime, Differentiate between business continuity (BC) and disaster recovery (DR) ,RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures.

UNIT- IV:

Architecture of backup/recovery and the different backup/recovery topologies, replication technologies and their role in ensuring information availability and business continuity, Remotereplication technologies and their role in providing disaster recovery and business continuity capabilities.

UNIT- V:

Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor for different components in a storage infrastructure, Key management tasks in a data center. Information security, Critical security attributes for information systems, Storage security domains, List and analyzes the common threats in each domain Virtualization technologies, block-level and file-level virtualization technologies and processes.

CASE STUDIES

The technologies described in the course are reinforced with EMC examples of actual solutions. Realistic case studies enable the participant to design the most appropriate solution for given sets of criteria.

TEXT BOOK

1. EMC Corporation, Information Storage and Management, Wiley.

REFERENCE BOOKS

1. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003.
2. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 2001.
3. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002.