VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE
(VJTI)

MATUNGA, MUMBAI 400 019

(Autonomous Institute affiliated to University of Mumbai)

Curriculum

(Scheme of Instruction & Evaluation and Course contents)

(Revision 2014)

For

Third Year

of

Four Year Undergraduate Programmes Leading to

Bachelor of Technology (B Tech) Degree in Computer Engineering

Implemented from the batch admitted in Academic Year 2014-15

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(Autonomous Institute affiliated to University of Mumbai)

Curriculum
(Scheme of Instruction & Evaluation and Course contents)

For
Second Year
of
Four Year Undergraduate Programme Leading to
Bachelor of Technology (B Tech)
In
107 Computer Engineering

B.Tech. Computer Engineering

Program Educational Objectives (PEOs)

1. To provide graduates with the ability to communicate effectively & successfully work in multi-disciplinary teams to succeed in diverse range of careers as engineers, consultants, and entrepreneurs.
2. To provide graduates with the ability to apply their skills and concepts acquired to continue further education in Computer engineering and interdisciplinary areas to emerge as researchers, domain experts, and educators.
3. To provide graduates with ability to re-learn and innovate in ever-changing global economic and technological environments of the current era.
4. To provide graduates with ability to practice technical standards and communicate to colleagues and the public at large about their work and accomplishments.
5. To provide graduates with the ability to function ethically and responsibly with good cultural values and integrity which would enable them to apply the best principles and practices of Computer engineering towards the society.

Program Outcomes (POs)

After the completion of the B.Tech. Computer Engineering programme, the graduates of the department will have the following abilities -

1. Students will demonstrate an ability to apply the knowledge of Mathematics, Science, Applied Mechanics, Engineering Graphics, Basic Electrical and Electronic Engineering, Basic Workshop Practices and Computer Engineering for the solution of complex engineering problems.
2. Students will demonstrate ability to identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusion using sound principles of Mathematics, Applied Sciences and Computer Science & Engineering.
3. Students will demonstrate an ability to design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, & the cultural, societal and environmental considerations using sound principle of Computer Engineering.
4. Students will demonstrate an ability to use research based knowledge and research methods in Computer Engineering including design of experiments, analysis & interpretation of data and synthesis of the information to provide valid conclusions.
5. Students will demonstrate an ability to create, select and apply appropriate techniques, resources and modern Computer engineering & IT modeling tools to complex engineering problems.

6. Students will demonstrate an ability to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Computer Engineering Practice.
7. Students will understand the impact of Computer Engineering solutions in societal & environmental contexts, and will demonstrate the knowledge of and need for sustainable solution development.
8. Students will be able to apply ethical principles and will commit to professional ethics, responsibilities, and norms of Computer engineering practice.
9. Students will be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary environments.
10. Students will demonstrate the ability to communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Students will demonstrate knowledge and understanding of the Computer Engineering and Management principles and apply these to his own work as a member and leader in a team to manage projects and in multidisciplinary environments.
12. Students will be able to recognize the need for, and will have the preparations and ability to engage in independent and life-long learning in the broadest context of technological change in Computer Engineering.

Veermata Jijabai Technological Institute

B. Tech. Computer Engineering

Scheme of Instruction and evaluation

SEMESTER V

Scheme of Instruction				Scheme of Evaluation				
S. No	**Course code**	**Course Title**	**L-T-P (Hours / week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1	MA3001S	Statistics and Optimization	3-1-0	4	10	30	60	3
2.	CO3002S	Artificial Intelligence	3-1-0	4	10	30	60	3
3.	CO3003_T	Software Engineering	3-0-0	3	10	30	60	3
	CO3003_P	Software Engineering Lab	0-0-2	1	100 % CIE			-
4.	CO3004_T	Computer Network Systems	3-0-0	3	10	30	60	3
	CO3004_P	Computer Network Systems Lab	0-0-2	1	100 % CIE			-
5.	CO3005S	Introduction to Operating Systems	3-1-0	4	10	30	60	3
6.	CO3006_T	Internet of Things	3-0-0	3	10	30	60	3
	CO3006_P	Internet of Things Lab	0-0-2	1	100 % CIE			-
		Total		24				

Abbreviations: **L**: Lecture, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment / Term work Assessment, **IST**: In Semester Tests (comprise of average of two In semester tests), **ESE**: End Semester Written Examination, **CIE**: Continuous In-semester Evaluation

B. Tech. Computer Engineering

Scheme of Instruction and evaluation

SEMESTER VI

Scheme of Instruction				Scheme of Evaluation				
S. No	**Course code**	**Course Title**	**L-T-P (Hours / week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1	CO3007S	Object Oriented Modeling & Design	3-1-0	4	10	30	60	3
2.	CO3008S	Machine Learning	3-1-0	4	10	30	60	3
3.	CO3009_T	Parallel Computer Architecture	3-0-0	3	10	30	60	3
	CO3009_P	Parallel Computer Architecture Lab	0-0-2	1	100 % CIE			-
4.	CO3010_T	Cryptography & Network Security	3-0-0	3	10	30	60	3
	CO3010_P	Cryptography & Network Security Lab	0-0-2	1	100 % CIE			-
5.		Elective1	3-1-0	4	10	30	60	3
6.	CO3011_T	Compiler Construction	3-0-0	3	10	30	60	3
	CO3011_P	Compiler Construction Lab	0-0-2	1	100 % CIE			-
		Web Technology						
		Total		24				

Abbreviations: **L**: Lecture, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment / Term work Assessment, **IST**: In Semester Tests (comprise of average of two In semester tests), **ESE**: End Semester Written Examination, **CIE**: Continuous In-semester Evaluation

Semester VI List of Elective 1:

S. No	Course code	Course Title
1.	CO3101S	Wireless Networking
2.	CO3102S	Graph Theory and Application
3.	CO3103_T	Linux Internals

Programme Name	**Bachelor of Technology in Computer Engineering**	**Semester – V**
Course Code	**MA3001S**	
Course Title	**Statistics and Optimization**	
Prerequisites	**Mathematics**	

COURSE OUTCOMES

1. Ability to solve problems by using least square analysis. Understand Correlation and Regression
2. Identify different types of test of Hypotheses
3. Identify different types of optimization problems and optimization technique
4. Ability to solve various multivariable optimization problems
5. Ability to solve optimization using software tools.

Course Contents

Probability

Baye's theorem. Discrete and continuous random variables. Probability mass function and density function. Expected value. (Expectation) Moments and moments generating functions. Relation between Raw moments and Central moments.

Statistics

1. Review of measures of central tendency, measures of variation and probability.
2. Discrete and continuous Random variable.
3. Binomial, Poisson and Normal distribution.
4. Random sampling, sampling distribution, standard error, Central limit theorem.
5. Estimation of parameters, point estimation, interval Estimation, confidence internal.
6. Testing of Hypothesis, large sample and small sample, tests't' test and 'F' test,
7. Chi-square test.
8. Correlation and regression.
9. Coefficient of correlation and Rank correlation
10. Regression analysis, curve fitting, method of least square
11. Statistical quality control and control charts.
12. Analysis of variance (One way & Two way).

Linear Optimization

Vector Spaces: bases, echelon forms, rank and determinants. Gauss elimination and its complexity, Inner products, Gram- Schmidt orthogonalization. Linear transformations. Optimization: Modelling and formulation of optimization problems.

Linear costs and convex domains. Mean-square (distance) minimizations. Linear programming and the Simplex algorithm. Duality and the primal dual method. Examples from combinatorial optimization. Shortest paths, network flows and matchings. Approximation and randomized algorithms. Matrix Games.

Text Books

1. C.Papadimitriou and K. Steiglitz, “Combinatiorial Optimization”, Prentice-Hall India, 1996.
2. Gilbert Strang, “Linear Algebra and its Applications”, Harcourt Brace Jovanovitch, 1988.

Reference Books

1. V. Chvatal, “Linear Programming and Applications”, 1982.
2. K. Hoffman and R. Kunze, “Linear Algebra”, Prentice-Hall India, 1971.
3. E.D. Nering and A.W.Tucker, “Linear Programs and Related Problems”, Academic Press, 1993

Programme Name	Bachelor of Technology in Computer Engineering	Semester – V
Course Code	CO3002S	
Course Title	Artificial Intelligence	
Prerequisites	Mathematics	

COURSE OUTCOMES

1. Describe the key aspects of intelligent agents.
2. Apply artificial intelligence techniques, including search heuristics, knowledge representation, planning and reasoning.
3. Solve problems by applying a suitable search method.
4. Compare minimax search and alpha-beta pruning in game playing.
5. Differentiate the key aspects of evolutionary computation, including genetic algorithms and genetic programming.

Course Contents

Introduction

Overview and historical perspective, turing test, physical symbol systems and the scope of symbolic AI, Agents.

State Space Search

Depth First Search, Breadth first Search, DFID.

Heuristic Search

Best First Search, Hill Climbing, Beam Search, Tabu Search.

Randomized Search

Simulated annealing, Genetic Algorithms, Ant colony optimization.

Finding Optimal Paths

Branch and Bound, A*, IDA*, Divide and Conquer approaches, Beam Stack Search.

Problem Decomposition

Goal Trees, AO*, Rule Based Systems, Rete Net.

Game Playing

Minimax Algorithm, AlphaBeta Algorithm,SSS*.

Planning and Constraint Satisfaction

Domains, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Constraint Propagation.

Logic and Inferences

Propositional Logic, First Order Logic, Soundness and Completeness, Forward and Backward chaining.

Text Books

1. Deepak Khemani,"A First Course in Artificial Intelligence", McGraw Hill Education(India), 2013.
2. Stuart Russell, Peter Norvig,"Artificial Intelligence A Modern Approach", Prentice Hall, 3rd Edition,2009.

Reference Books

1. Stefan EdelKamp and Stefan Schroedl, "Heuristic Search: Theory and Application", Morgan Kaufmann, 2011.
2. Zbigniew Michalewicz and David B. Fogel, " How to Solve it: Modern Heuristics", Springer, 2nd Edition, 2004.

Programme Name	Bachelor of Technology in Computer Engineering	Semester – V
Course Code	CO3003_T	
Course Title	Software Engineering	
Prerequisites		

COURSE OUTCOMES

1. Student will demonstrate basic knowledge in Software Engineering.
2. Student will be able to plan, gather requirements for, analyse, design, develop and test the software development project.
3. Student will be able to estimate cost, effort & time, manage risk, prepare project schedule and track it for a software development project.
4. Student will be able to assure the quality of a software & manage its configuration.

Course Contents

Introduction

The Product: Software Characteristics, Applications.
The Process: Software Process, Software Process Models, Linear Sequential model, Prototyping model, RAD model, Evolutionary models - Incremental model, Spiral model.

Software project management concepts

Important factors of project management- People, Product, Process, Project.

Software Process and Project Metrics

Measures, Metrics, Indicators. Metrics in the process and project domains, Software measurement. Metrics for Software Quality. Integrating metrics.

Software Project Planning

Software Scope, Resources, Software project estimation - cost/effort estimation, Decomposition techniques, Empirical estimation models.

Risk Analysis and Management

Reactive versus proactive risk strategies, Software risks, Risk identification, Risk projection,

Risk mitigation-monitoring-management, RMMM plan.

Project Scheduling and Tracking

Defining a task set for the software project, Gantt Chart, Defining a task network, Scheduling.

Software Quality Assurance

Software quality assurance, Software reviews, Formal technical reviews, SQA plan.

Software Configuration Management

SCM process, Identification of objects in the software configuration, Version control, Change control, Configuration audit, Status reporting.

Analysis Concepts and Principles

Requirement Analysis, Requirement elicitation for software, Analysis principles, Software prototyping, Requirements Specification.

Analysis Modelling

Data modelling, Functional modelling and information flow, Behavioural modelling.

Design Concepts and Principles

Software design process, Design principles, Design concepts, Effective modular design.

Design Modelling

Data Design. Architectural Design: Software architecture, Mapping requirements into a software architecture. User Interface Design: Human Factor, User interface design process. Component-Level Design: Structured programming design notations.

Software Testing Techniques & Strategies

White-box & Black-box testing techniques. Strategic Approach to Software Testing.

Text Books

1. Roger Pressman, “Software Engineering”, McGraw Hill, Fifth Edition.

2. Ian Sommerville, “Software Engineering”, Pearson Education. Sixth Edition.

Reference Books

1. James Peter ,”Software Engineering an Engineering approach”, John Wiley, First Edition
2. W. S. Jawadekar, “Software Engineering”, TMH. 1st Edition
3. R. Mall, “Fundamentals of Software Engineering”, Prentice Hall of India, 2nd Edition

Programme Name	Bachelor of Technology in Computer Engineering	Semester – V
Course Code	CO3003_P	
Course Title	Software Engineering Lab	
Prerequisites		

COURSE OUTCOMES

1. Students will be able to carry out different framework activities of software development project such as requirements gathering, analysis, design, coding, testing and maintenance.
2. Students will be able to carry out different umbrella activities of software development project such as cost & time estimation, risk management, project scheduling & tracking, software quality assurance & software configuration management.

Experiment Detail

For a given case study do the following -

- Give detailed Problem Statement
- Prepare Software scope
- Estimate required Resources
- Perform Software cost and time Estimation
- Perform Risk Analysis and prepare RMMM plan for case study
- Prepare Project Schedule
- Prepare Software Quality Assurance Plan (SQA plan)
- Prepare Project Plan
- Carry out Requirement Analysis Modeling
- Prepare SRS in IEEE format
- Carry out Software Design
- Develop test cases for white box testing.
- Assignment / code for stubs and drivers.
- Change specifications and make different versions using any SCM tool.

Text Books

1. "Software Engineering", Roger Pressman, McGraw Hill, Fifth Edition.
2. "Software Engineering", Ian Sommerville, Pearson Education. Sixth Edition.

Reference Books

1. Software Engineering an Engineering approach, James Peter, John Wiley, First Edition

2. Software Engineering, W. S. Jawadekar, TMH. 1st Edition
3. Fundamentals of Software Engineering, R. Mall, Prentice Hall of India, 2nd Edition

Programme Name	Bachelor of Technology in Computer Engineering	Semester – V
Course Code	CO3004_T	
Course Title	Computer Network Systems	
Prerequisites		

COURSE OUTCOMES

1. Students will obtain insight about basic network theory and layered communication architectures
2. Students will be able to analyze, design and document computer network specifications to meet client needs, use proper computer system and networking terminology
3. Students will able to implement local area networks using both static and dynamic addressing techniques including sub netting, install and configure domain-based local area networks
4. Students will be able to understand conceptual design of MAC, IP, and Transport layer protocols and solve problems in MAC, IP, and Transport layers.

Course Contents

Introduction

Data Communication System and its components, Data Flow, Computer network and its goals, Types of computer networks: LAN, MAN, WAN, Wireless and wired networks, broadcast and point to point networks, Network topologies, Network software: concept of layers, protocols, interfaces and services, ISO-OSI reference model, TCP/IP reference model

Network Layer

Design issues, Bridges - Routers – Gateways, Routing algorithms, Congestion control , algorithms, Quality of Service, Internetworking, Address learning bridges, Spanning tree, Source routing, IP datagram, hop by hop routing, ARP/RARP, Subnet addressing – Address, masking, ICMP, RIP/RIPV2, OSPF, DNS

Transport Layer

Services, Transport layer protocols, UDP, TCP: State Transition diagram, flow control, error control, TCP Timers. Congestion control and Quality of Service: Queuing disciplines, TCP Congestion control, Congestion Avoidance Mechanisms, Quality of Service

Applications

Traditional Applications(WWW, HTTP, FTP, Email, Telnet, SSH, DNS), Peer-to-Peer Networks, Socket programming

Text Books

1. B. A. Forouzan and Firouz Mosharraf, “Computer Networks, A Top-Down Approach”, McGraw-Hill, 2012.
2. Andrew S. Tanenbaum, “Computer Networks”, Pearson Education,4th Edition.
3. J.F. Kurose and K. W. Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, Pearson, 2nd Edition, 2003.

Reference Books

1. Larry L Peterson and B S Davie, “Computer Networks: A Systems Approach”, Elsevier,2012
2. B. A. Forouzan, “Data Communications and Networking”, McGraw Hill, 4th Edition ,2010.
3. William Stallings, “Data and computer Communication”, Pearson Education, 7th Edition.
4. Alberto Leon Garcia and Indra Widjaja, “Communication Networks, Fundamental Concepts and Key Architectures”, McGraw-Hill, 2nd Edition, 2004.

Programme Name	Bachelor of Technology in Computer Engineering	Semester – V
Course Code	CO3004_P	
Course Title	Computer Network Systems Lab	
Prerequisites		

COURSE OUTCOMES

1. Students will be able to use simulation tools
2. Students will implement the various protocols.
3. Students will be able to analyze the performance of the protocols in different layers.
4. Students will be able to analyze various routing algorithms

Experiment List

1. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
2. Study of Socket Programming and Client – Server model
3. Write a code simulating ARP /RARP protocols.
4. Write a code simulating PING and TRACEROUTE commands
5. Create a socket for HTTP for web page upload and download.
6. Write a program to implement RPC (Remote Procedure Call)
7. Implementation of Subnetting .
8. Applications using TCP Sockets like
   a. Echo client and echo server
   b. Chat
   c. File Transfer
9. Applications using TCP and UDP Sockets like
   a. DNS
   b. SNMP
   c. File Transfer
10. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS
11. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer.
    i. Link State routing
    ii. Flooding
    iii. Distance vector

Programme Name	Bachelor of Technology in Computer Engineering	Semester – V
Course Code	CO3005S	
Course Title	Introduction to Operating Systems	
Prerequisites	Computer Organization & Architecture, Basic C/C++ programming course	

COURSE OUTCOMES

1. Students will be able to explain the basic structure and functioning of operating system and its role as System software.
2. Students will be able to point the problems related to process management and synchronization as well as is able to apply learned methods to solve basic problems.
3. Students will be capable of explaining the cause and effect related to deadlocks and will be able to apply various concepts related with Deadlock to solve problems related with Resources allocation, after checking system in Safe state or not.
4. Students will be able to explain the basics of memory management, the use of virtual memory in modern operating systems, the structure of the most common file-systems, File management, Disk management and I/O management.
5. Students will be able to explain how process, memory and I/O management is carried out in Linux and Windows operating systems.

Course Contents

Introduction

1.1 Introduction to Operating System, Objectives and Functions of Operating System, Evolutions of Operating System, Types of Operating Systems, Operating system structure, Operating system's generic components

1.2 General working of an Operating Systems: BIOS, Booting/Bootstrapping, Privileged instructions, System calls, Types of system calls, System Boot.

Process Management

2.1 Process concept, Process description, PCB, Threads, Thread Management, Process Scheduling: basic concepts, scheduling criteria, scheduling algorithms, Preemptive, Non-preemptive, FCFS, SJF SRTN, Priority based, Round Robin, Multi level queue scheduling.

2.2 Process Concurrency: Principles of concurrency; the critical section problem, Mutual Exclusion- Hardware approaches; Mutual Exclusion- Software Support; Semaphores; Monitors, Message Passing; Readers/Writers Problem.

Synchronization, Classic problem of synchronization: The Producer Consumer problem.

2.3 Deadlock and Starvation: Principles of Deadlock, Deadlock Prevention, Avoidance, Detection. Deadlock avoidance Banker's algorithm for single & multiple resources , Deadlock recovery

Memory Management

Memory Management Requirements, Memory Partitioning, Concept Virtual Memory, Paging and Segmentation, Demand paging, page replacement algorithms, Thrashing, Memory, Design and implementation issues.

File Management & Disk Management

File System Structure, File System Implementation, File Directories implementation, Allocation Methods, Free space management.

Secondary storage: Structures**,** Disk scheduling Algorithms, Disk Management.

I/O Management

Basics of I/O management, I/O subsystem, I/O Buffering, Application I/O Interface.

Case Studies

Overview of Linux operating system, Process and thread management, Scheduling, concurrency control mechanisms, Memory management and I/O management in Linux.

Overview of Windows operating system: Process and thread management, Scheduling, concurrency control mechanisms, Memory management and I/O management in windows.

Text Books

1. Silberschatz A.,Galvin P., Gagne G. " Operating Systems Principles", Willey Publication
2. William Stallings, "Operating Systems", Pearson Education, 4th Edition.
3. Andrew S. Tanenbaum, "Modern Operating Systems", 2/e, Prentice Hall India.

Reference Books

1. Dhamdhare D. M., "Operating Systems – A Concept-Based Approach", McGraw Hill Publications, 2nd Edition.
2. Naresh Chauhan, "Principles of Operating Systems", Oxford University Press.

3. Flynn Ida M., McHoes A.M., “Understanding Operating Systems”, Thomson Publication, 4th Edition.
4. Milan Milenkovic, “Operating System”, McGraw Hill Publications.
5. Achyut S. Godbole , Atul Kahate, “Operating Systems”, McGraw Hill Publications, 3rd Edition.

Programme Name	Bachelor of Technology in Computer Engineering	Semester – V
Course Code	CO3006_T	
Course Title	Internet of Things	
Prerequisites		

COURSE OUTCOMES

1. Students will be able to understand digital transformation.
2. Students will be able to understand the IoT infrastructure and its applications.
3. Students will be capable of analyze the system and use appropriate architecture, and protocols for a given scenario .
4. Students will be able to understand the use of cloud platform and its framework for the development of IoT applications.
5.

Course Contents

Introduction to Digital Transformation

What is digital disruption? Examples of Digital Disruption.Waves of Digital Disruption,Why Digital Disruption,examples, What are the emerging digital technologies? 2016 Top 10 Tech Trends,The Digital Technology Stack,Digital Innovation. The SMAC (Social,Mobile,Analytics,Cloud) Stack - SMAC – Foundational Technology Stack, SMAC – The Basic Enablers

The Innovation Accelerator Stack : The Digital Technology Stack -MACHINE LEARNING/ COGNITIVE, AUGMENTED REALITY, VIRTUAL REALITY, AUTOMATION/ ROBOTICS, 3D PRINTING,BIG DATA,WEARABLES

INTERNET OF THINGS - The New Design Principles
The Digital Technology Stack - USER EXPERIENCE DESIGN, OMNI CHANNEL, DESIGN THINKING/ DEV OPS, DIGITAL MARKETING,

Introduction to IoT

Introduction to IoT, Future of IoT,Applications of IoT,Advantages of IoT,Enabling Technologies. Overview of Internet of Things, building blocks of IoT, characteristics of IoT systems and IoT levels. IoT and M2M, IoT design methodology, Technology Considerations -

IoT Problem Statement, IoT – Technology Enablers, IoT Technology Stack , IoT – Data Considerations,Some Interesting IoT Projects, Introduction to Complexity, IoT - Challenges

IoT Applications

Retail, Healthcare & Agriculture

IoT Architecture

Reference Architecture, Study and usage of various types of sensors and actuators, IoT devices, gateways

IoT Physical Devices & Endpoints

Microprocessor, Microcontroller,Microcomputer hardware and software concepts.

Study and usage of Protyping boards like - Arduino, Intel edison, rapberry pi etc (from software and hardware perspective) programming using sketches,c and python. Other programming languages used for IoT. A generic design methodology for Internet of Things.

Communication

Introduction to communication architecture- Network protocol stack, Different protocols: RF: ZigBee, Blue Tooth, BLE, Zwave, Mesh network. Communication Channels: GSM/GPRS, 2G, 3G, LTE, WiFi , IoT protocols: MQTT/MQTTS, CoAP, 6LoWPAN, like TCP, UDP, HTTP/S.

Comparison of the different IoT protocols, advantages and disadvantages (limitations) of these IoT protocols.

IPv4 addressing problem for IoT and introduction to IPv6 is required to address more devices.

Application issues with RF protocol - power consumption, LOS, reliability. Security aspects.Showcase the GSM module.

Cloud platform and framework for developing IoT

An introduction to the use of cloud platforms and frameworks for developing IoT applications.Data Analytics for IoT.

Text Books

1. Arshdeep Bahga, Vijay Madisetti - Internet of Things, A Hands-on Approach,Universities Press, 2015.

Reference Books

1. Stephanie Moyerman, “Getting Started withIntel Edison”, Published by Maker Media, Inc., San Francisco, 2016. CA 94111.
2. Agus Kurniawan , “Arduino Uno:A Hands-On Guide for Beginner ,1st Edition,2015
3. John Boxall , “Arduino Workshop A Hands-On Introduction with 65 Projects”, No Starch Press, Inc.San Francisco, CA USA, 2013
4. Internet sources: Arduino site, Intel IoT site, Raspberry pi site

Programme Name	**Bachelor of Technology in Computer Engineering**	**Semester – V**
Course Code	**CO3006_P**	
Course Title	**Internet of Things Lab**	
Prerequisites		

COURSE OUTCOMES

1. Student should be able to understand different architecture and implement the protocol for communication. .
2. Student should be able to design IoT project for different applications.

Course Contents

IoT lab consist of performing atleast 10 experiment covering complete syllabus using simmulation and using prototypying boards, sensors, actuators using sketches and python programking language. Student may use other language for lab/project work.

Student will form a group of 4-5 and submit a proposal for IoT related project. At the end of the semester project shall be presented and evaluated based on content and demonstartion.

Programme Name	**Bachelor of Technology in Computer Engineering**	**Semester – VI**
Course Code	**CO3007S**	
Course Title	**Object Oriented Modeling & Design**	
Prerequisites		

COURSE OUTCOMES

1. Students will be able to comprehend software development life cycle.
2. Students will be able to prepare SRS document for a project.
3. Students will be capable of applying software design and development techniques.
4. Students will be able to identify verification and validation methods in a software engineering project.
5. Students will be capable of analyzing and applying object modeling for the problem.
6. Students will be able to identify verification and validation methods in a software engineering project

Course Contents

Introduction

Overview Of OOL; Object Classes; Meta Types. Object Oriented Methodologies; The Unified Approach Modeling; Why Modeling? Static And Dynamic Models; Functional Models.

Object Modeling

Object. Links. Association. Inheritance. Grouping Constructs; Problems On Object Modeling; Advantages Of Object Modeling.

Analysis

Problem Analysis. Problem Domain Classes. Identify Classes And Objects Of Real World Problems. Using Use Case Analysis; Recording Analysis.

Basic Object Modeling

Multiplicity. Constraints. Aggregation. Component.

Sequence Diagram

Modeling Scenarios. Mapping Events To Object. Interfaces. Discovering Attributes. Modeling Simple Collaboration Modeling. Logical Database Schema. Activity Diagram. Modeling Workflow.

Class Diagram

Test Scenarios. Interfaces. Classes. Methods. Stress Testing. System Testing. Scalability Testing. Regression Testing. Behavioral Modeling. State Chart Diagram.

Design

Architectural Design. Refining The Model. Refactoring. Coupling And Cohesion . Who Should Own The Attribute? Who Should Own The Operations? Process And Threads.

Design Classes

Classes Visibility; User Interface. Subsystem Interface.

Deponent Diagram

Modeling Source Codes. Physical Databases.

Deployment Diagram

Modeling In A C/S System. Distributed System And Embedded Systems.

Text Books

1. Ali Bahrami, “Object Oriented System Development “, McGraw Hill.
2. Grady Booch, J. Rambaugh, Ivar Jacobson, ”The UML Users guide”, Pearson Education.
3. Andrew Haigh, “Object Oriented Analysis and Design”, Tata McGrawHill

Reference Books

1. Simon Benett, Steve McRobb, Ray Farmer, “Object Oriented System Analysis and Design Using UML”, McGrawHill.
2. Timothy C. Lethbridge, Robert Laganiere, “Object Oriented Software Engineering”, McGrawHill.

Programme Name	Bachelor of Technology in Computer Engineering	Semester – VI
Course Code	CO3008S	
Course Title	Machine Learning	
Prerequisites	Linear Algebra, Probability, Statistics	

COURSE OUTCOMES

1. Student will be able to analyze and appreciate the applications which can use Machine Learning Techniques.
2. Student will be able to understand regression, classification, clustering methods.
3. Student will be able to understand the difference between supervised and unsupervised learning methods.
4. Student will be able to appreciate Dimensionality reduction techniques.
7. Student will be able to understand the working of Reinforcement learning.

Course Contents

Introduction

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

Instant Based Learning

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.
Association Rule Learning: Apriori, FP Growth
Clustering: Centroid based – K-means, Distribution based – EM, Density based – DBScan
Regression: Linear Regression, Interpolation & Extrapolation, Nonlinear regression

Bayesian And Computational Learning

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

Neural Networks And Genetic Algorithms

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning

Advanced Learning

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm –Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

Text Books

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill, 1st edition, 1997.
2. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation & Machine Learning)", The MIT Press 2004
3. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.

Reference Books

1. Hastie. T, Tibshirani. R, Friedman. J. H, "The Elements of Statistical Learning", Springer,1st edition, 2001.
2. William W.Hsieh, "Machine Learning Methods in the Environmental Sciences", Cambridge Publication.
3. Han Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann Publishers.

Programme Name	Bachelor of Technology in Computer Engineering	Semester – VI
Course Code	CO3009_T	
Course Title	Parallel Computer Architecture	
Prerequisites	Knowledge of Computer Organization and Architecture , Operating Systems and C/C++ programming	

COURSE OUTCOMES

1. Understand different ways of achieving parallelism.
2. Understand the components and operation of a memory hierarchy & I/O and the performance issues influencing its design.
3. Understand the organisation and operation of different parallel computer architectures such as Pipelined processor, SIMD Array processor, Multiprocessor and Multi-core systems, superscalar processor & GPU based architectures.

Course Contents

Introduction to Parallel and Pipeline Processing

a. Evolution of Computer Systems, Necessity of high performance, Constraints of conventional architecture
b. Parallelism in Uniprocessor Systems, Instruction level Parallelism and Thread Level Parallelism.
c. Evolution of Parallel processors, Parallel Computer Structures, Future Trends
d. Processor - Architectural Classification Schemes

Memory Subsystems in parallel environment

a. Hierarchical Memory Structure: Interleaved memory - structure, performance
b. Virtual Memory - utilisation, locality of reference, performance
c. Cache Memory - structure, performance, implementation, optimisation

I/O and secondary storage

a. I/O techniques- polling, interrupts, direct memory access
b. I/O channels, I/O processors - structures, bandwidth issues

Pipelining and Vector Processing

a. Pipelining : An Overlapped Parallelism, Principles and implementation of Pipelining. Classification of pipelining processors. Study and comparison of processors with and without pipelining. General pipelining reservation table
b. Instruction and Arithmetic Pipelining : Design Aspects
c. Principles of Designing Pipelined Processors : Pipelining hazards and resolving techniques, Data buffering techniques, Job sequencing and Collision detection.
d. Data level parallelism: Vector processing
e. Superscalar Architecture.

SIMD Computer Organization

a. SIMD Array Processors: Masking and Data network mechanism, Inter PE Communication
b. Communication: SIMD Interconnection networks, Static Vs Dynamic Network, Cube, hyper cube, Mesh Interconnection Network
c. Associative Array Processors
d. Parallel Algorithms for Array Processors: Matrix Multiplication algorithm, Sorting algorithm and their analysis.
e. Performance Enhancement Methods of SIMD Array Processors

Multiprocessor and Multicore Architectures

a. Functional Structures: Loosely and Tightly coupled multiprocessors, Processor characteristics of multiprocessors
b. Interconnection Networks: Time shared bus, Crossbar switch, Multiport Memory Model, Memory contention and arbitration techniques, Cache coherency
c. Parallel Memory Organizations for multiprocessors
d. Exploiting Concurrency for Multiprocessing : Implementation issues of a program on multiprocessor system, critical sections, semaphores, monitor, producer-consumer problem. Deadlocks: prevention, avoidance, detection
e. Parallel Algorithms for Multiprocessors, Parallel Programming Languages: Fortran 90
f. Multicore systems : Structure, performance, complexity, power consumption, memory utilization
g. GPU based Architecture, CPU-GPU integration.

Text Books

1. Computer Architecture: A Quantitative Approach (Third Edition), John Hennessy and David Patterson, Morgan Kaufmann Publishers, 2003.
2. Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing" McGraw-Hill international Edition.
3. D. E. Culler and J. P. Singh with A. Gupta, "Parallel Computer Architecture", Morgan- Kaufmann publishers.

Reference Books

1. V.Rajaraman, L Sivaram Murthy, "Parallel Computers", PHI.
2. Kai Hwang, “Scalable Parallel Computing”.
3. Harrold Stone, “High performance computer Architecture”.
4. Richard Y. Kain, “Advanced Computer Architecture”
5. Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill

Programme Name	Bachelor of Technology in Computer Engineering	Semester – VI
Course Code	CO3009_P	
Course Title	Parallel Computer Architecture Lab	
Prerequisites	Knowledge of Computer Organization and Architecture , Operating Systems and C/C++ programming	

COURSE OUTCOMES

1. Student will be able to understand different aspects of parallel processing environment.
2. Student will be able to design parallel algorithms and implement parallel programs.

Experiment List

1. Simulation of virtual memory systems
2. Simulation of cache memory systems
3. To learn basics of MPI (Message Passing Interface)
4. To learn Communication between MPI processes
5. To get familiarized with advance communication between MPI processes
6. To learn basics of OpenMP API (Open Multi-Processor API)
7. To get familiarized with OpenMP Directives
8. Implementation of Convex hull algorithm
9. Implementation of z-buffer algorithm
10. Implementation of a shared linked list
11. Parallel algorithm for carrying out different matrix operations
12. Implementation of Telephone directory using RMI
13. Implementation of parallel search algorithm

Text Books

1. Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing" McGraw-Hill international Edition

2. Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill

Reference Books

1. V.Rajaraman, L Sivaram Murthy, "Parallel Computers", PHI.

2. William Stallings, "Computer Organization and Architecture, Designing for performance" Prentice Hall, Sixth edition.
3. Kai Hwang, “Scalable Parallel Computing”.
4. Harrold Stone, “High performance computer Architecture”.
5. Richard Y. Kain, “Advanced Computer Architecture”.
6. http://www.intel.com/products/processor (for Intel Itanium Processor)

Programme Name	Bachelor of Technology in Computer Engineering	Semester – VI
Course Code	CO3010_T	
Course Title	Cryptography & Network Security	
Prerequisites	Computer Networks	

COURSE OUTCOMES

1. Students will be able to compare various cryptographic techniques
2. Students will be able to use mechanisms like authentication, digital signature, MAC to avoid security attacks.
3. Students will be able to analyze the threats in networks in various layers of networks.
4. Students will be able to identify the need for firewalls, intrusion detection and prevention system

Course Contents

Introduction

Security Attacks, Types of Attacks, Active and Passive Attacks, Services and Mechanisms , Classical cryptosystems , Substitution and Transposition Ciphers ,Cryptanalysis , Stream and Block Ciphers , Shannon's Theory of Confusion and Diffusion.

Mathematical Foundations

Basic Number Theory , Congruences ,Chinese Remainder theorem ,Modular exponentiation ,Fermat and Euler's theorem , Finite fields, Discrete Logarithms.

Symmetric key Ciphers

Modern Block Ciphers - DES, AES, Modes of Operation of Block Ciphers, Differential Cryptanalysis ,Triple DES , Stream Ciphers , Pseudorandom Functions

Asymmetric key Cryptography

RSA Cryptosystem , El Gamal Cryptosystem, Elliptic Curve based Cryptography, Diffie Hellman Key Exchange.

Crptographic Hash Functions

Merkle Damgard Construction , Applications of Cryptographic Hash Functions, Secure Hash Algorithm, Message Authentication Code- Message Authentication Requirements and Functions, ,HMAC, Digital Signature Schemes

Network Security Applications

Authentication Applications, Needham Shroeder Protocol , Kerberos , X.509 Certificates, Public Key Infrastructure

Network Security

Threats in Networks , IP Spoofing, SYN Flooding , Denial of Service Attacks , Smurf Attacks ,ARP Spoofing, Transport Layer Security ,Secure Socket Layer Protocol , IP Layer Security , IPsec, IKE protocol Email security – Pretty Good Privacy PGP, S/MIME

System security

Intruders , Malicious software , Viruses,Worms and Trojans, Firewalls , Features of Firewall, Types of Firewalls ,Placement of Firewalls , Configuration of Firewalls , Intrusion Detection System – Types of IDS, Intrusion Prevention System

Text Books

1. Behrouz Forouzan and Debdeep Mukhopadhyay, Cryptography and Network Security, Tata McGraw Hill ,3rd edition,
2. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013

Reference Books

1. Charles Pfleeger,Security in Computing, 4th Edition, Prentice Hall of India, 2006.
2. Atul Kahate, Cryptography and Network Security,3rd edition, Tata McGraw Hill,2013

Programme Name	Bachelor of Technology in Computer Engineering	Semester – VI
Course Code	CO3010_P	
Course Title	Cryptography and Network Security Lab	
Prerequisites	Computer Networks	

COURSE OUTCOMES

1. Students will be able to write programs for different cryptographic algorithms.
2. To perform cryptanalysis of the different cryptographic algorithms
3. Students will be able to understand and use cryptographic techniques to provide security to the network.
4. Students will be able to understand and use the packet analyzer, packet building tools, and intrusion detection and intrusion prevention systems.

Course Contents

1a. To implement and perform cryptanalysis of the shift cipher

1b. To implement and perform cryptanalysis the Mono-alphabetic Substitution Cipher

1c. To implement and perform cryptanalysis of Polyalphabetic Substitution Ciphers
a)Playfair Cipher

1d. To implement Vignere Cipher

1e. To implement Hill Cipher

1f. To implement Transposition Ciphers

   a. Columnar Cipher
   b. Railfence Cipher

2. To implement encryption / decryption in client server program
3. Implement DES in ECB mode
4. To generate RSA private-public key pair and to demonstrate
   a. Encryption and decryption
   b. Digital signature
5. To implement MAC using DES in CBC mode

6. To implement client server program using Diffie Hellman key exchange to create session key and implement the authentication using challenge response protocol.
7. Perform an experiment to demonstrate how to sniff for router traffic by using Wireshark and demonstrate ARP poisoning
8. Study of email spoofing.
9. Study of firewall.

Text Books

1. Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", McGraw Hill ,3rd edition.
2. William Stallings, "Cryptography and Network Security", Pearson Education, 6th Edition, March 2013.

Reference Books

1. Charles Pfleeger, "Security in Computing", Prentice Hall of India, 4th Edition, 2006.
2. Atul Kahate, "Cryptography and Network Security", McGraw Hill,3rd edition, 2013.

Programme Name	Bachelor of Technology in Computer Engineering	Semester – VI
Course Code	CO3011_T	
Course Title	Compiler Construction	
Prerequisites	Theory of Automata	

COURSE OUTCOMES

1. Students will be able to apply the knowledge of Lex tool & Yacc tool to devleop a scanner & parser.
2. Students will be able to understand and design code generator.
3. Students will be able to learn the new code optimization techniques to improve the performance of a program in terms of speed & space.

Course Contents

Language Processors

Translators - Compilers and Interpreters,The Phases of Compilers,Errors in different phases, Analysis and Synthesis phases, Compiler Construction Tools.

Lexical Analysis

Role of Lexical Analyzer, , Input buffering, Expressing Tokens by Regular Expressions , Converting regular expressions to DFA, Minimization of DFA, LEX tool, Design of Lexical Analyzer for a sample Language.

Syntax Analysis

Role of the Parser, Context Free Grammars ,Top-down parsing, Recursive descent and predictive parsers LL(1) parser, Bottom-Up parsing, Operator precedence parsing, LR, SLR and LALR Parser, Error Handling and Recovery in Syntax Analyzer,YACC tool, Design of a Syntax Analyzer for a Sample Language .

Syntax Directed Translation

Syntax directed Definitions, Construction of Syntax Tree, Top-down translation and Bottom-up evaluation of inherited attributes, Design of predictive translator ,Type Systems,Specification of a simple type checker, Equivalence of Type Expressions,Type Conversions.

Run Time Environments

Storage Organization, Activation Trees, Activation Records, Stack Allocation of activation records,Parameter passing mechanisms

Intermediate Code Generation

Intermediate languages: graphical representations, data flow analysis, DAGs, Three address code, Types of three address statements, Syntax directed translation into three address codes, Implementation of three address statements.

Code Optimization

Machine dependent and machine independent code optimization, Sources of Optimization, Early Optimizations: Constant-Expression Evaluation (Constant Folding, Algebraic Simplifications and Reassociation, Value numbering, Copy Propagation. Redundancy Elimination: Common-Subexpression Elimination, Loop-Invariant Code Motion, Partial-Redundancy Elimination, Redundancy Elimination and Reassociation, Code Hoisting. Loop Optimizations: Induction-Variable optimizations, Unnecessary Bounds Checking Elimination.

Code Generation: Issues in the design of a code generator, The target machine, Run-time storage Management, Basic blocks and flow graphs, Next-use information, A simple code generator.

Text Books

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", Pearson ,2nd edition

Reference Books

1. Leland Beck , "System Software", Addision Wesley
2. Kenneth C. Louden; "Compiler Construction, Principles and Practice", Cengage Learning.
3. D.M.Dhamdhere , "System programming and Operating System", McGraw Hill , 2nd revised edition,1999,.

Programme Name	Bachelor of Technology in Computer Engineering	Semester – VI
Course Code	CO3011_P	
Course Title	Compiler Construction Lab	
Prerequisites	Theory of Automata	

COURSE OUTCOMES

1. Students will be able to apply the knowledge of Lex tool & Yacc tool to devleop a scanner & parser.
2. Students will be able to understand and design code generator.
3. Students will be able to learn the new code optimization techniques to improve the performance of a program in terms of speed & space.

Experiment List

1. Write a program for separation of tokens for a given expression.
2. Implement a predictive parser for the given grammar
3. Implement the shift reduce parsing algorithm
4. Constructing LR parsing table
5. Generation of DAG for the given expression
6. Simulation of Symbol Table Management
7. Generate code for the given intermediate code
8. Implement lexical analyzer using LEX
9. Implement parser using LEX nd YACC

Text Books

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", Pearson ,2nd edition

Reference Books

1. Leland Beck , "System Software", Addision Wesley

2. Kenneth C. Louden; “Compiler Construction, Principles and Practice”, Cengage Learning.
3. D.M.Dhamdhere , “System programming and Operating System”, McGraw Hill ,1999, 2nd revised edition.

Programme Name	Bachelor of Technology in Computer Engineering	Semester – VI
Course Code	CO3101S	
Course Title	Wireless Networks	
Prerequisites	Computer Networks	

COURSE OUTCOMES

1. To demonstrate the fundamentals of wireless technology.
2. To demonstrate knowledge of the mobile network.
3. To demonstrate working knowledge of wireless protocols for communication.
4. To demonstrate the knowledge of wireless networks.

Course Contents

Wireless Communication

Cellular systems- Frequency Management and Channel Assignment- types of handoff and their characteristics, dropped call rates & their evaluation - MAC – SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks

Wireless Lan

IEEE 802.11 Standards – Architecture – Services – Mobile Ad hoc Networks- WiFi and WiMAX - Wireless Local Loop

Mobile Communication Systems

GSM-architecture-Location tracking and call setup- Mobility management- Handover-Security-GSM SMS –International roaming for GSM- call recording functions-subscriber and service data mgt –-Mobile Number portability -VoIP service for Mobile Networks – GPRS –Architecture-GPRS procedures-attach and detach procedures-PDP context procedure-combined RA/LA update procedures-Billing

Mobile Network and Transport Layers

Mobile IP – Dynamic Host Configuration Protocol-Mobile Ad Hoc Routing Protocols– Multicast routing-TCP over Wireless Networks – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freezing-Selective

Retransmission – Transaction Oriented TCP- TCP over 2.5 / 3G wireless Networks

Application Layer

WAP Model- Mobile Location based services -WAP Gateway –WAP protocols – WAP user agent profile- caching model-wireless bearers for WAP - WML – WMLScripts - WTA - iMode- SyncML

Text Books

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2003.
2. William Stallings, "Wireless Communications and Networks", Pearson Education, 2002.

Reference Books

1. Kaveh Pahlavan, Prashanth Krishnamoorthy, "Principles of Wireless Networks", Pearson Education, 1st Edition, 2003.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
3. C. K. Toh, "AdHoc Mobile Wireless Networks", Pearson Education, 1st Edition, 2002.

Programme Name	Bachelor of Technology in Computer Engineering	Semester – VI
Course Code	CO3102S	
Course Title	Graph Theory and Application	
Prerequisites		

COURSE OUTCOMES

1. Students will be able to apply the knowledge of Vertex cover, matching theorem.
2. Students will be able to understand connectivity and coloring of the graph.
3. Students will be able to learn the new special classes of graph, network flow, probabilistic method and minor theory of graph.

Course Contents

Covering Problem

Vertex Cover, Matchings theorem and applications, Pathcover theorem and applications

Connectivity

2-connected and 3- connected graphs, Hamiltonicity, k-linkedness

Coloring

Vertex Coloring, Edge Coloring, List Coloring, Chromatic Polynomial, k-critics graphs, Acyclic coloring, Other Coloring Problems

Special classes of graphs

Perfect graphs, Weak Perfect Graph Theorem, Planar graphs, Other special classes of graphs.

Network flow

Network flows, Circulation and tensions, Chapter 6: Random Graphs and Probabilistic Methods

Random Graph and Probabilistic Methods

Random Graph, Probabilistic Methods, Markov, Chebishey Inequalities, Lovasz Local Lemma

Minor Theory

Introduction to minor theory, tree decomposions

Text Books

1. R. Diestel, "Graph Theory", Springer-Verlag, 3nd edition, 2006.

Reference Books

1. R. Balakrishanan and K Ranganathan, "Graph Theory", Springer-Verlag, 2nd edition, 2012.

Programme Name	Bachelor of Technology in Computer Engineering	Semester – VI
Course Code	CO3103S	
Course Title	Linux Internals	
Prerequisites		

COURSE OUTCOMES

1. Understand various process management concepts including scheduling, synchronization, deadlocks in Linux .
2. Will be familiar with multithreading and parent child processing.
3. Understand the inter process communication in Linux.
4. Understands the issues related to file system.

Course Contents

Introduction

Introduction to Linux & Open source, GPL, LGPL licensing, Introduction to various, flavors to Linux, Using the command line interface, Components of Linux

System Calls

User and Kernel Space,Introduction to System Calls,System Calls in Detail,Strace – Tracing system calls

Process

Introduction to Process, Process vs. Program, Process States, Creating Process, Process termination, Special case of processes.

Inter Process Communication (IPC)

Introduction to IPC, Pipe, FIFO, Shared Memory,Advantages and Disadvantages of

various IPC mechanisms,Application use cases.

Signals

Introduction to Signals, Default disposition of Signals,Handling the Signals,Signal Related Functions,

Threads

Introduction to Thread

Text Books

1. Silberschatz & Galvin, “Operating system concepts”, Addison Wesley ,7th edition.
2. Tanenbaum A.S, “Modern Operating Systems”, Pearson Education 3rd edition, 2008 .
3. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall, 2008.

Refernce Books

1. Gary Nutt, Nebendu Chaki, and Sarmistha Neogy, “Operating Systems”, Pearson Education, 3rd edition, 2009
2. Jerry D. Peek, Grace Todino, John Strang, “Learning the Unix Operating System”, O'Reilly & Associates Publication, 5th edition, 2002
3. Crowley C., “Operating Systems – A Design oriented Approach”, TMH