SEMESTER III

PCE16301 SOFTWARE ARCHITECTURE 3 0 0 3

COURSE OBJECTIVES

- To understand the architectural requirements
- To identify the architectural structures.
- To develop the architectural documentation.
- To generate the architectural alternatives.
- To evaluate the architecture against the drivers.

UNIT I ARCHITECTURAL DRIVERS 9

Introduction – Standard Definitions of Software Architecture– Architectural structures – Influence of software architecture on organization – Architecture Business Cycle – Functional requirements – Technical constraints Quality Attributes – Quality Attribute Workshop (QAW) – Documenting Quality Attributes – Six part scenarios.

UNIT II ARCHITECTURAL VIEWS AND DOCUMENTATION 9

Introduction – Standard Definitions for views – Structures and views- Perspectives: Static, dynamic and physical and the accompanying views – Representing views-available notations – Good practices in documentation– Documenting the Views using UML – Merits and Demerits of using visual languages – Need for formal languages Architectural Description Languages – ACME.

UNIT III ARCHITECTURAL STYLES 9

Introduction – Data flow styles – Call-return styles – Shared Information styles – Event styles – Case studies for each style.

UNIT IV ARCHITECTURAL DESIGN 9

Approaches for architectural design – System decomposition – Attributes driven for specific quality design – Architecting attributes – Performance, Availability – Security – Architectural conformance.

UNIT V ARCHITECTURE EVALUATION AND SOME SPECIAL TOPICS 9

Need for evaluation – Scenario based evaluation against the drivers – ATAM and its variations – Case studies in architectural evaluations – SOA and Web services – Cloud Computing – Adaptive structure

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the student should be able to

- understand the key architectural drivers and the influence of architecture on business and technical activities.
- adopt good practices for documenting the architecture.
- develop alternative architectures for a given problem.
- use formal languages to specify architecture
- describe the recent trends in software architecture.

TEXT BOOKS

1. Len Bass, Paul Clements, and Rick Kazman, “Software Architectures Principles and Practices”, 2nd Edition, Addison-Wesley, 2003.
2. Anthony J Lattanze, “Architecting Software Intensive System. A Practitioner's Guide”, Auerbach Publications, 2010.

REFERENCES

1. Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers, Reed Little, Paulo Merson, Robert Nord, and Judith Stafford, “Documenting Software Architectures. Views and Beyond”, 2nd Edition, Addison-Wesley, 2010.
2. Paul Clements, Rick Kazman, and Mark Klein, “Evaluating software architectures: Methods and case studies.” Addison-Wesley, 2001.
3. RajkumarBuyya, James Bromberg, and AndrzejGoscinski, “Cloud Computing. Principles and Paradigms”, John Wiley & Sons, 2011.

WEB LINKS

1. https://www.tutorialspoint.com
2. https://www.cs.cmu.edu/afs/cs/project/tinker-arch
3. https://www.codementor.io

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

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

PCE16302 NETWORK AND INFORMATION SECURITY 3 0 0 3

COURSE OBJECTIVES

- To familiarize the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity
- To realize the various key distribution and management schemes
- To understand how to deploy encryption techniques to secure data in transit across data networks.
- To design security applications in the field of Information technology.

UNIT I INTRODUCTION 9

An Overview of Computer Security- Security Services- Security Mechanisms-Security Attacks- Access Control Matrix, Policy- Security policies, Confidentiality policies, Integrity policies and Hybrid policies.

UNIT II CRYPTOSYSTEMS &AUTHENTICATION 9

Classical Cryptography-Substitution Ciphers - permutation Ciphers - Block Ciphers - DES - Modes of Operation - AES - Linear Crypt analysis, Differential Cryptanalysis - Hash Function - SHA512 – Message Authentication Codes - HMAC - Authentication Protocols.

UNIT III PUBLIC KEY CRYPTOSYSTEMS **9**

Introduction to Public key Cryptography- Number theory- The RSA Cryptosystem and Factoring Integer-Attacks on RSA -The ELGamal Cryptosystem- Digital Signature Algorithm-Finite Fields- Elliptic Curves Cryptography-Key management- Session and Interchange keys ,Key exchange and generation-PKI

UNIT IV SYSTEM IMPLEMENTATION 9

Design Principles, Representing Identity, Access Control Mechanisms ,Information Flow and Confinement Problem - Secure Software Development: Secured Coding - OWASP/SANS Top Vulnerabilities – Buffer Overflows- Incomplete mediation - XSS - Anti Cross Site Scripting Libraries- - Canonical Data Format - Command Injection-Redirection-Inference-Application Controls

UNIT V NETWORK SECURITY 9

Secret Sharing Schemes-Kerberos- Pretty Good Privacy(PGP)-Secure Socket Layer(SSL)- Intruders- HIDS-NIDS-Firewalls-Viruses.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the student should be able to

- estimate the performance and throughput of a given network
- design a network aimed at optimum performance
- identify and analyses security problems in networks.
- apply appropriate security techniques to solve security problems
- understand the legal, copyright and privacy issues.

TEXT BOOKS

1. Menezes Bernard, "Network Security and Cryptography", Cengage Learning, New Delhi,2011
2. William Stallings, "Cryptography and Network Security: Principles and Practices", Third Edition, Pearson Education, 2006.

REFERENCES

1. Matt Bishop, "Computer Security art and science ", Second Edition, Pearson Education, 2002
2. Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education,2007
3. Jonathan Katz, and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press, 2007
4. Douglas R.Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC,2006

WEBLINKS

1. www.youlinux.com
2. http://xml.coverpages.org/OWASP-TopTen.pdf

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

ELECTIVE III

PCE16351 **INTERNET OF THINGS** **3 0 0 3**

COURSE OBJECTIVES

- To identify and design the new models for market strategic interaction.
- To develop business intelligence and information security for Internet of Things (IoT).
- To compare various protocols for IoT.
- To develop a middleware for IoT.
- To develop different models for network dynamics.

UNIT I INTRODUCTION **9**

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information. Security.

UNIT II IOT PROTOCOLS **9**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols- Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus-KNX – Zigbee Architecture – Network layer – APS layer – Security.

UNIT III WEB OF THINGS **9**

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

UNIT IV INTEGRATED **9**

Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things – Network Dynamics: Population Models – Information Cascades - Network Effects - Network Dynamics: Structural Models - Cascading Behaviour in Networks - The Small-World Phenomenon

UNIT V APPLICATIONS **9**

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production - Resource Management in the Internet of Things: Clustering, Synchronization and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the student should be able to

- identify and design the new models for market strategic interaction
- design business intelligence and information security for web
- analyses various protocols for IOT
- design a middleware for IOT

- analyses and design different models for network dynamics

TEXT BOOKS

1. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012
2. Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles- (Eds.) – Springer- 2011

REFERENCES

1. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press – 2010
2. The Internet of Things: Applications to the Smart Grid and Building Automation by - Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley -2012
3. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012

WEBLINKS

1. https://www.linkedin.com/pulse/web-links-projects-iot-varsity
2. https://www.peterindia.net/TheInternetofThings.html

Mapping of Course Outcomes with Programming Outcomes
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CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16352 **REALTIME SYSTEMS** **3 0 0 3**

COURSE OBJECTIVES

- To provide good understanding of fundamental concepts in real time systems..
- To realize the advanced topics and areas in real time systems
- To understand the basic multi-task scheduling algorithms for periodic and sporadic tasks as well as understand the impact of the latter woon scheduling.
- To expose the capabilities of commercial off-the-shelf R-T kernel
- To expose to real time communications and databases.

UNIT I INTRODUCTION **9**

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

UNIT II REAL TIME SCHEDULING **9**

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective- Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling A periodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

UNIT III RESOURCES SHARING **9**

Effect of Resource Contention and Resource Access Control (RAC), Non-pre-emptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority - Ceiling Protocol in Dynamic Priority Systems, Pre-emption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects.

UNIT IV REAL TIME COMMUNICATION **9**

Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.

UNIT V REAL TIME OPERATING SYSTEMS AND DATABASE **9**

Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Concurrency Control, Overview of Commercial Real Time databases

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the student should be able to

- know the basics and importance of real-time systems.
- create a high-level analysis document based on requirements specifications
- make a high-level design document based on analysis documentation
- generate the test and validation plan based on requirements specification based on documentation
- understand capabilities of at least one commercial off-the-shelf r-t kernel.

TEXT BOOKS

1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.

REFERENCES

1. Mall Rajib, "Real Time Systems", Pearson Education.
2. Albert M. K. Cheng, "Real-Time Systems: Scheduling, Analysis, and Verification", Wiley.

WEBLINKS

1. http://www.realtime-info.be/
2. http://www.eg3.com/navi/real.html
3. http://www.realtime-info.be/encyc/techno/publi/faq/rtos_faq_table.html

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

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CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16353 **COMPUTER VISION** **3 0 0 3**

COURSE OBJECTIVES

- To review image processing techniques for computer vision
- To be aware of shape and region analysis
- To understand Hough Transform and its applications to detect lines, circles, ellipses
- To realize three-dimensional image analysis techniques
- To recognize motion analysis for 3 dimensional objects

UNIT I IMAGE PROCESSING FOUNDATIONS 9

Review of image processing techniques - classical filtering operations - thresholding techniques –edge detection techniques - corner and interest point detection-mathematical morphology-texture.

UNIT II SHAPES AND REGIONS 9

Binary shape analysis -connectedness -object labelling and counting -size filtering - distance functions – skeleton and thinning - deformable shape analysis - boundary tracking procedures-active contours-shape models and shape recognition- centroidal profiles-handling occlusion-boundary length measures-boundary descriptors-chain codes-Fourier descriptors-region descriptors- moments

UNIT III HOUGH TRANSFORM 9

Line detection -Hough Transform (HT) for line detection -foot-of-normal method -line localization -line fitting-RANSAC for straight line detection -HT based circular object detection -accurate center location -speed problem ellipse detection -Case study: Human Iris location - hole detection - generalized Hough Transform (GHT) – spatial matched filtering-GHT for ellipse detection- object location-GHT for feature collation.

UNIT IV 3D VISION AND MOTION 9

Methods for 3D vision - projection schemes - shape from shading - photometric stereo- shape from texture - shape from focus - active range finding -surface representations - point- based representation-volumetric representations-3D object recognition - 3D reconstruction -introduction to motion-triangulation -bundle adjustment -translational alignment – parametric motion - spline-based motion- optical flow-layered motion.

UNIT V APPLICATIONS 9

Application: Photo album - Face detection - Face recognition - Eigen faces - Active appearance and 3D shape offices Application: Surveillance -fore ground-back ground separation -particle filters -Chamfer matching ,tracking, and occlusion-combining views from multiple cameras - human gait analysis Application: In-vehicle vision system: locating roadway - road markings -identifying road signs-locating pedestrians

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the student should be able to

- put into practice fundamental image processing techniques required for computer vision
- perform shape and region analysis
- realize boundary tracking techniques
- apply 3d vision techniques
- implement motion related techniques and develop applications using computer vision techniques

REFERENCES

1. E.R.Davies, "Computer &Machine Vision", Fourth Edition, Academic Press, 2012.
2. R.Szeliski, "Computer Vision: Algorithms and Applications", Springer 2011.
3. Simon J.D.Prince, "Computer Vision: Models, Learningand Inference", Cambridge UniversityPress, 2012.
4. Mark Nixonand Alberto S.Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012.
5. D.L.Baggioetal, "Mastering Open CV with Practical Computer Vision Projects", Packt Publishing, 2012.
6. Jan Erik Solem," Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.

WEB LINKS

1. http://nptel.ac.in/courses/106105032/
2. http://nptel.ac.in/courses/117105079/
3. http://www.nptelvideos.in/2012/12/digital-image-processing.html

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

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

PCE16354 **RESEARCH METHODOLOGY** **3 0 0 3**

COURSE OBJECTIVES

- To develop a hypothesis, a research problem and related questions.
- To frame the problem with the correct research methodology.
- To collect data that accurately addresses the research problem.
- To use data to make decisions.
- To evaluating feasibility of research proposals.

UNIT I INTRODUCTION **9**

The nature of CS research - what is research? - Project planning, tools and techniques for planning – Literature searches, information gathering.

UNIT II PROJECT DEVELOPMENT **9**

Reading and understanding research papers - Project implementation and IT project management. – Presentation skills, written and oral - Time management- Team working.

UNIT III OPTIMIZATION METHODS **9**

Linear Programming: Simplex method – Dynamic Programming – Integer Programming - Hill climbing.

UNIT IV 3D VISION AND MOTION **9**

Simulated annealing - Quantum annealing - Genetic algorithms - Ant colony optimization - Particle swarm optimization - Tabu search - Beam search.

UNIT V APPLICATIONS **9**

Commercial and economic considerations in the IT industry - Review of Legal, Ethical, Social and Professional (LSEP) issues, such as data protection, hacking, etc. - Technical writing, referencing, bibliographies.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the student should be able to

- prepare a preliminary research design for projects in their subject matter areas .
- accurately collect, analyze and report data .
- present complex data or situations clearly.
- produce optimized project outcome.
- review and analyze research findings that affect their agency.

REFERENCES

1. C. W. Dawson, The Essence of Computer Projects: A Student Guide. New Delhi: PHI, 2006.
2. Duane A. Bailey, A Letter to Research Students. Massachusetts.
3. Humdy Taha, Operation Research. New Delhi: PHI, 2007.
4. S. Kirkpatrick and C. D. Gelatt and M. P. Vecchi. Optimization by Simulated Annealing, Science, Vol 220, 1983, 671-680.
5. B. Apolloni, N. Caravalho and D. De Falco. Quantum stochastic optimization, Stochastic Processes and their Applications, Vol. 33, 1989, 233-244.

6. David E. Goldberg. Genetic Algorithms in Search, Optimization, and Machine Learning, New Delhi : New Age, 1989.

WEB LINKS

1. http://nptel.ac.in/courses/107108011/
2. http://nptel.ac.in/syllabus/107108011/
3. http://www.nptel.ac.in/syllabus/121106001/

Mapping of Course Outcomes with Programming Outcomes
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CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16355 DESIGN AND ANALYSIS OF PARALLEL ALGORITHMS 3 0 0 3

COURSE OBJECTIVES

- To learn various models of parallel algorithms
- To understand the performance of parallel computation
- To expose the students to parallel sorting and merging algorithms
- To understand the various concept of parallel searching algorithm
- To analyse parallel algorithms

UNIT I INTRODUCTION 9

Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

UNIT II PERFORMANCE MEASURES OF PARALLEL ALGORITHMS 9

Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Cost- optimality, An example of illustrate Cost- optimal algorithms- such as summation, Min/Max on various models.

UNIT III PARALLEL SORTING NETWORKS 9

Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC, Parallel Sorting Networks on CREW/EREW/MCC/, linear array.

UNIT IV PARALLEL SEARCHING ALGORITHM 9

Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

UNIT V PARALLEL GRAPH ALGORITHM 9

Graph Algorithms - Connected Graphs, search and traversal, Combinatorial Algorithms- Permutation, combinations, Derangements.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the student should be able to

- identify the need for parallel algorithms
- discuss the classification of parallel architectures and identify suitable programming models
- perform sorting on CREW, EREW models
- implement optimized searching and sorting algorithms
- apply parallel graph algorithms to find real time solutions

REFERENCES

1. M.J. Quinn, “Designing Efficient Algorithms for Parallel Computer”, McGrawHill.
2. S.G. Akl, “Design and Analysis of Parallel Algorithms”.
3. Jaja, “Introduction to Parallel algorithms”, Pearson, 1992.
4. S.G. Akl,”Parallel Sorting Algorithm” by Academic Press.

WEB LINKS

1. http://nptel.ac.in/courses/106106112/
2. http://nptel.ac.in/syllabus/106106112/
3. http://nptel.ac.in/courses/106104120/Assignment.pdf

Mapping of Course Outcomes with Programming Outcomes **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak**														
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CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

ELECTIVE IV

PCE16451 MODEL CHECKING AND PROGRAM VERIFICATION 3 0 0 3

COURSE OBJECTIVES

- To understand automata model
- To analyse LTL, CTL, and CTL*
- To understand timed automata, TCTL, and PCTL
- To analyse verification of deterministic and recursive programs
- To expose verification of object-oriented programs, parallel, distributed, and non-deterministic programs

UNIT I AUTOMATA AND TEMPORAL LOGICS 9

Automata on finite words-model checking regular properties-automata on infinite words- Buchi automata – Linear Temporal Logic (LTL) - automata based LTL model checking - Computational Tree Logic (CTL) - CTL model Checking - CTL*model checking.

UNIT II TIMED AND PROBABILISTIC TREELOGICS 9

Timed automata - timed computational tree logic (TCTL) - TCTL model checking - probabilistic systems - Probabilistic computational tree logic (PCTL) - PCTL model checking - PCTL*- Markov decision processes.

UNIT III VERIFYING DETERMINISTIC AND RECURSIVE PROGRAMS 9

Introduction to program verification -verification of "while" programs -partial and total correctness – verification of recursive programs -case study: binary search -verifying recursive programs with parameters.

UNIT IV VERIFYING OBJECT-ORIENTED AND PARALLEL PROGRAMS 9

Partial and total correctness of object - oriented programs - case study: Insertion in linked lists - verification of disjoint parallel programs -verifying programs with shared variables- case study: parallel zero search-verification of synchronization -case study: the mutual exclusion problem.

UNIT V VERIFYING NON-DETERMINISTIC AND DISTRIBUTED PROGRAMS 9

Introduction to non-deterministic programs - partial and total correctness of non- deterministic programs-case study: The Welfare Crook Problem- syntax and semantics of distributed programs-verification of distributed programs -case study: A Transmission Problem-introduction to fairness.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the student should be able to

- do model checking using LTL
- make model checking using CTL
- perform and compare model checking using TCTL and PCTL
- verify deterministic and recursive programs
- verify object-oriented programs, parallel, distributed, and non-deterministic programs

REFERENCES

1. J. B. Almeida, M. J. Frade, J. S. Pinto and S. M. deSousa, "Rigorous Software Development: An Introduction to Program Verification", Springer, 2011
2. C.Baier, J.-P.Katoenand K.G.Larsen, "Principles of Model Checking", MITPress, 2008.
3. E.M.Clarke, O.Grumberg and D.A.Peled, "Model Checking", MIT Press, 1999.
4. M.Ben-Ari, "Principles of the SPIN Model Checker", Springer, 2008.
5. K.R.Apt, F.S.deBoer, E.-R.Olderogand A.Pnueli, "Verification of Sequential andConcurrent Programs", third Edition, Springer, 2010.
6. M.Huth and M.Ryan,"Logic in Computer Science-Modeling and Reasoning about Systems", Second Edition,Cambridge University Press, 2004.
7. B.Berardetal, "Systems and Software Verification: Model-checking techniques and tools", Springer, 2010.

WEBLINKS

1. https://www.mimuw.edu.pl/~vbarany/TL_course.html
2. http://why.lri.fr/manual/manual003.html
3. http://www.inf.ed.ac.uk/teaching/courses/propm/papers/CTL.html

Mapping of Course Outcomes with Programming Outcomes
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COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
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CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16452 **ROBOTICS** **3 0 0 3**

COURSE OBJECTIVES

- To expose the students about the fundamentals of robotic systems
- To understand the concepts of actuators and controls of Robot
- To know about 2D & 3D transformations and its uses
- To expose the knowledge of Cell Design of Robot and its usage in various application
- To learn working principles of Micro /Nano Robotics through various techniques

UNIT I INTRODUCTION **9**

Robot anatomy - Definition, law of robotics, History and Terminology of Robotics - Accuracy and repeatability of Robotics - Simple problems Specifications of Robot-Speed of Robot - Robot joints and links-Robot classifications Architecture of robotic systems - Robot Drive systems Hydraulic, Pneumatic and Electric system.

UNIT II END EFFECTORS AND ROBOT CONTROLS **9**

Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type- Magnetic grippers- Vacuum grippers - Air operated grippers-Gripper force analysis - Gripper design-Simple problems - Robot controls- point to point control, Continuous path control, Intelligent robot-Control system for robot joint- Control actions – Feedback Devices - Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.

UNIT III ROBOT TRANSFORMATIONS AND SENSORS **9**

Robot kinematics – Types - 2D, 3D Transformation - Scaling, Rotation, Translation - Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors.

UNIT IV ROBOT CELL DESIGN AND APPLICATIONS **9**

Robot work cell design and control - Sequence control, Operator interface, Safety monitoring devices in Robot - Mobile robot working principle, actuation using MATLAB, NXT Software Introductions - Robot applications Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea Robot.

UNIT V MICRO/NANO ROBOTICS SYSTEM **9**

Micro/Nano robotics system overview - Scaling effect - Top down and bottom up approach - Actuators of Micro/ Nano robotics system – Nano robot communication techniques-Fabrication of micro/Nano grippers-Wall climbing micro robot working principles - Biomimetic robot-Swarm robot – Nano robot in targeted drug delivery system.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the student should be able to

- know the basics of robot
- understand end effectors and robot controls
- gain knowledge about robot transformations and sensors
- design robot cell applications
- understand micro/nano robotic systems

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8. Craig. J. J. "Introduction to Robotics mechanics and control", Addison- Wesley, 1999.
9. Ray Asfahl. C., "Robots and Manufacturing Automation", John Wiley & Sons Inc., 1985.

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2. https://www.youtube.com/watch?v=T0SK5A1rwdk
3. https://www.youtube.com/watch?v=o3IhGZY0TCE

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

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

PCE16453 **BIO - INSPIRED COMPUTING** **3 0 0 3**

COURSE OBJECTIVES

- To understand Cellular Automata and artificial life
- To study artificial neural networks and its evolution
- To learn developmental and artificial& biological immune systems
- To realize behavioral systems especially in the context of Robotics
- To recognize collective systems such as ACO,PSO and swarm robotics

UNIT I EVOLUTIONARYAND CELLULARSYSTEMS 9

Foundations of evolutionary theory – Genotype – artificial evolution – genetic with representations – initial population – fitness functions – selection and reproduction– genetic operators – evolutionary measures –evolutionary algorithms –evolutionary electronics – evolutionary algorithm case study: Cellular systems – cellular automata – modelling with cellular systems – other cellular systems – computation cellular systems –artificial life –analysis and synthesis of cellular systems.

UNIT II NEURALSYSTEMS 9

Biological nervous systems–artificial neural networks –neuron models –architecture –signal encoding– synaptic plasticity– unsupervised learning– supervised learning– reinforcement learning–evolution of neural networks– hybrid neural systems–case study

UNIT III DEVELOPMENTAL AND IMMUNESYSTEMS 9

Rewritingsystems–synthesisofdevelopmentalsystems–evolutionaryrewritingsystems– evolutionary applications developmental programs Biological immune systems – lessons for artificial immune systems – algorithms and –shape space –negative selection algorithm –clonal selection algorithm - examples.

UNIT IV BEHAVIORALSYSTEMS 9

Behaviour is cognitive science – behaviour in AI – behaviour based robotics – biological inspiration for robots–robots as biological models– robot learning–evolution of behavioural systems– learning in behavioural systems– co-evolution of body and control– towards self-reproduction–simulation and reality

UNIT V COLLECTIVE SYSTEMS 9

Biological self-organization –Particle Swarm Optimization (PSO)–ant colony optimization (ACO) – swarm robotics – co-evolutionary dynamics – artificial evolution of competing systems–artificial Evolution of cooperation–case study.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the student should be able to

- implement and apply evolutionary algorithm
- explain cellular automata and artificial life
- implement and apply neural system
- explain developmental, artificial immune systems and explain behavioural systems
- implement and apply collective intelligence systems

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2. F. Neumann and C .Witt, " Bio inspired Computation in combinatorial optimization: Algorithms and their computational complexity", Springer, 2010.
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4. Simon O. Haykin, "Neural Networks and Learning Machines", Third Edition, Prentice Hall, 2008.

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

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

PCE16454 PATTERN RECOGNITION AND ANALYSIS 3 0 0 3

COURSE OBJECTIVES

- To know about supervised and unsupervised learning
- To study about feature extraction and structural pattern recognition.
- To explore different classification models.
- To understand hidden markov models.
- To understand fuzzy pattern classifiers and perception.

UNIT I PATTERN CLASSIFIER 9

Overview of Pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Problems with Bayes approach – Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT II CLUSTERING 9

Clustering for unsupervised learning and classification – Clustering concept – C Means algorithm - Hierarchical clustering – Graph theoretic approach to pattern Clustering – Validity of Clusters.

UNIT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION 9

KL Transforms – Feature selection through functional approximation – Binary selection - Elements of Formal grammars - Syntactic description - Stochastic grammars - Structural representation.

UNIT IV HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE 9

State Machines – Hidden Markov Models – Training – Classification – Support vector Machine – Feature Selection.

UNIT V RECENT ADVANCES 9

Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms – Case Study Using Fuzzy Pattern Classifiers and Perception.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the student should be able to,

- classify the data and identify the patterns.
- analyze the pattern clustering and its validity.
- extract feature set and select the features from given data set.
- identify the hidden markov models.
- understand the advances in fuzzy pattern classifiers.

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1. M. Narasimha Murthy and V. Susheela Devi, “Pattern Recognition”, Springer 2011.
2. S.Theodoridis and K.Koutroumbas, “Pattern Recognition”, 4th Ed., Academic Press, 2009
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2. http://videolectures.net/Top/Computer_Science/Machine_Learning/Pattern_Recognition/
3. http://www.learnerstv.com/Free-engineering-Video-lectures-ltv832-Page1.htm

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

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CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

PCE16455 MULTIMEDIA SYSTEMS 3 0 0 3

COURSE OBJECTIVES

- To learn various operations in multimedia and its uses.
- To recognize the various components of multimedia and the standards
- To realize various multimedia systems used in real time world.
- To study about the multimedia tools and its usage
- To understand how to develop multimedia application

UNIT I INTRODUCTION 9

Introduction – Multimedia presentation and production – Characteristics – Multiple media – Utilities – Uses – Promotion – Creation – Digital representation – Multimedia architecture.

UNIT II COMPONENTS OF MULTIMEDIA 9

Text: Text compression - file formats – Image – Audio – Video: Transmission of video signals- Television Broadcasting standards - Digital video standards – Animation: Key frames and Tweening – Principles of animation– 3D animation – file formats– Multimedia documents.

UNIT III MULTIMEDIA SYSTEMS 9

Visual display systems: Video adapter card – Video adapter cable – Optical storage media – CD technology– DVD technology – Compression: CODEC – Types and techniques – GIF image coding standards –Lossy /Perceptual – JPEG – MPEG-1– MPEG-2 – Fractals.

UNIT IV MULTIMEDIA TOOLS 9

Authoring Tools: features and types – Card and page based tools – Icon and object based tools – Time based tools – Cross platform authoring notes – Basic software tools: OCR software – 3D modeling and animation tools.

UNIT V MULTIMEDIA APPLICATION DEVELOPMENT 9

Software life cycle – ADDIE model – Conceptualization – Content collection and processing – Story – Flow line – Script – Storyboard – Implementation – Authoring metaphors – Testing and feedback – Final delivery – Report writing/ documentation – Case study: Web application – Console application – Distributed application – Mobile application – Games consoles – itv – Kiosks

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the student should be able to

- study of basic multimedia concepts and architecture.
- understand of various multimedia components technology and animation
- understand of multimedia system concepts
- uses of multimedia tools
- applications of multimedia in web and mobile environment.

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CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2