**PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018**

**(AUTONOMOUS)**

**M.E. COMPUTER SCIENCE AND ENGINEERING**

**CURRICULUM**

**REGULATIONS 2015**

**III SEMESTER**

| Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| PCE15301 | Software Architecture | 3 | 0 | 0 | 3 |
| PCE15302 | Network and Information Security | 3 | 0 | 0 | 3 |
| PCE15E** | Elective III | 3 | 0 | 0 | 3 |
| PCE15E** | Elective IV | 3 | 0 | 0 | 3 |
| PCE15303 | Project Work (Phase I) | 0 | 0 | 12 | 6 |

**IV SEMESTER**

| Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| PCE15401 | Project Work (Phase II) | 0 | 0 | 24 | 12 |

**LIST OF ELECTIVES**

**ELECTIVE III**

| Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| PCE15E11 | Internet of Things | 3 | 0 | 0 | 3 |
| PCE15E12 | Real Time Systems | 3 | 0 | 0 | 3 |
| PCE15E13 | Computer Vision | 3 | 0 | 0 | 3 |
| PCE15E14 | Research Methodologies | 3 | 0 | 0 | 3 |
| PCE15E15 | Design and Analysis of Parallel Algorithms | 3 | 0 | 0 | 3 |

**ELECTIVE IV**

| Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| PCE15E16 | Model Checking and Program Verification | 3 | 0 | 0 | 3 |
| PCE15E17 | Robotics | 3 | 0 | 0 | 3 |
| PCE15E18 | Bio-inspired Computing | 3 | 0 | 0 | 3 |
| PCE15E19 | Protocols and Architecture for Wireless Sensor Networks | 3 | 0 | 0 | 3 |
| PCE15E20 | Multimedia Systems | 3 | 0 | 0 | 3 |

**III SEMESTER**

**PCE15301 SOFTWARE ARCHITECTURES 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 design – Architecting for specific quality 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: 45 PERIODS**

**COURSE OUTCOMES**

At the end of the 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.

- explain how to use formal languages to specify architecture.
- describe the recent trends in software architecture.

**REFERENCES**


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

**PCE15302 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-Viruse

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

At the end of the 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 analyse security problems in networks.
- apply appropriate security techniques to solve security problems.
- understand the legal, copyright and privacy issues.
- implement virus free network services.

**REFERENCES**


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.
3. Matt Bishop, "Computer Security art and science ", Second Edition, Pearson Education, 2002
4. Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education,2007
5. Jonathan Katz, and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press, 2007
6. DouglasR.Stinson,"CryptographyTheoryandPractice",ThirdEdition,Chapman&Hall/CRC,2006
7. Wenbo Mao, "Modern Cryptography - Theory and Practice", Pearson Education, FirstEdition, 2006.

## ELECTIVE III

**PCE15E11 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 – 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 Behavior 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 Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

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

- identify and design the new models for market strategic interaction

- design business intelligence and information security for WoB
- analyse various protocols for IoT
- design a middleware for IoT
- analyse and design different models for network dynamics

**REFERENCES**


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

**PCE15E12 REAL TIME 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 two on 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 Aperiodic 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 DATABASES 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: 45 PERIODS**

**COURSE OUTCOMES**

At the end of the 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.

**REFERENCES**


1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.
2. Mall Rajib, “Real Time Systems”, Pearson Education
3. Albert M. K. Cheng, “Real-Time Systems: Scheduling, Analysis, and Verification”, Wiley.

**PCE15E13 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
- To study some applications of computer vision algorithms

**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 - skeletons 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-volume tric representations- 3D object recognition - 3D reconstruction -introduction to motion-triangulation -bundle adjustment -translational alignment-parametricmotion-spline-basedmotion-opticalflow-layeredmotion

**UNIT V APPLICATIONS 9**

Application: Photo album - Face detection - Face recognition - Eigen faces - Active appearance and 3D shape models of faces 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: 45 PERIODS**

**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 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, Learning and Inference", Cambridge University Press, 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.

**PCE15E14 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 ADVANCED OPTIMIZATION TECHNIQUES 9**

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

**UNIT V ISSUES AND TECHNICAL WRITING 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: 45 PERIODS**

**COURSE OUTCOMES**

At the end of the 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
- 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.

**PCE15E15 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: 45 PERIODS**

**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
- search a sorted as well as random sequence

**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.

## ELECTIVE IV

**PCE15E16 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
- To expose verification of 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: 45 PERIODS**

**COURSE OUTCOMES**

At the end of the 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
- verify 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.Katoen and 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.Olderog and A.Pnueli, "Verification of Sequential and Concurrent 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.

**PCE15E17 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** 10

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** 8

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: 45 PERIODS**

**COURSE OUTCOMES**

At the end of the 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

**REFERENCES**


1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics,Technology programming and Applications, McGraw Hill, 2012
3. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Robotics Engineering an Integrated Approach, Phi Learning., 2009.
4. Francis N. Nagy, Andras Siegler, Engineering foundation of Robotics, Prentice Hall Inc., 1987.
5. P.A. Janaki Raman, Robotics and Image Processing an Introduction, Tata McGraw Hill Publishing company Ltd., 1995.
6. Carl D. Crane and Joseph Duffy, Kinematic Analysis of Robot manipulators, Cambridge University press, 2008.
7. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., "Robotics control, sensing, vision and intelligence", McGraw Hill Book co, 1987
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.

**PCE15E18 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 behavioural systems especially in the context of Robotics
- To recognize collective systems such as ACO, PSO, and swarm robotics

**UNIT I EVOLUTIONARY AND CELLULAR SYSTEMS 9**

Foundations of evolutionary theory – Genotype – artificial evolution –genetic 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 with cellular systems – artificial life – analysis and synthesis of cellular systems.

**UNIT II NEURAL SYSTEMS 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 IMMUNE SYSTEMS 9**

Rewriting systems – synthesis of developmental systems – evolutionary rewriting systems – evolutionary developmental programs Biological immune systems – lessons for artificial immune systems – algorithms and applications – shape space – negative selection algorithm – clonal selection algorithm - examples.

**UNIT IV BEHAVIORAL SYSTEMS 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: 45 PERIODS**

**COURSE OUTCOMES**

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

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

**REFERENCES**


1. D. Floreano and C. Mattiussi, "Bio-Inspired Artificial Intelligence", MIT Press, 2008.
2. F. Neumann and C. Witt, "Bioinspired Computation in combinatorial optimization: Algorithms and their computational complexity", Springer, 2010.
3. A. E. Elben and J. E. Smith, "Introduction to Evolutionary Computing", Springer, 2010.
4. Simon O. Haykin, "Neural Networks and Learning Machines", Third Edition, Prentice Hall, 2008.
5. M. Dorio and T. Stutzle, "Ant Colony Optimization", A Bradford Book, 2004.

**PCE15E20 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: 45 PERIODS**

**COURSE OUTCOMES**

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

- design and conduct experiments, as well as to analyze, interpret data on experiments relevant to computer science and engineering practice.
- design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.
- use the techniques, skills, and modern engineering tools necessary for engineering practice.

**REFERENCES**


1. R. Parekh, Principles of Multimedia, New Delhi: Tata McGraw-Hill, 2010.
2. Tay Vaughan, Multimedia: Making It Work, New Delhi: McGraw-Hill Professional, 2007.
3. Ralf Steinmetz and Klara Nahrstedt, Multimedia: Computing, Communications and Applications, New Delhi: Pearson Education, 2012.
4. Fred Halsall, Multimedia Communication-Application Networks, Protocols and Standard, Singapore: Addison -Wesley, 2008.