



SPPU B.E./B.Tech CSE Sem 7 syllabus

Artificial Intelligence and Robotics

410242: Artificial Intelligence and Robotics

Credit 03

Unit I Introduction 08 Hours

Artificial Intelligence: Introduction, Typical Applications. State Space Search: Depth Bounded DFS, Depth First Iterative Deepening. Heuristic Search: Heuristic Functions, Best First Search, Hill Climbing, Variable Neighborhood Descent, Beam Search, Tabu Search. Optimal Search: A algorithm, Iterative Deepening A* , Recursive Best First Search, Pruning the CLOSED and OPEN Lists.

Unit II Problem Decomposition and Planning 08 Hours

Problem Decomposition: Goal Trees, Rule Based Systems, Rule Based Expert Systems. Planning: STRIPS, Forward and Backward State Space Planning, Goal Stack Planning, Plan Space Planning, A Unified Framework For Planning. Constraint Satisfaction : N-Queens, Constraint Propagation, Scene Labeling, Higher order and Directional Consistencies, Backtracking and Look ahead Strategies.

Unit III Logic and Reasoning 08 Hours

Knowledge Based Reasoning: Agents, Facets of Knowledge. Logic and Inferences: Formal Logic, Propositional and First Order Logic, Resolution in Propositional and First Order Logic, Deductive Retrieval, Backward Chaining, Second order Logic. Knowledge Representation: Conceptual Dependency, Frames, Semantic nets.

Unit IV Natural Language Processing and ANN 08 Hours

Natural Language Processing: Introduction, Stages in natural language Processing, Application of NLP in Machine Translation, Information Retrieval and Big Data Information Retrieval. Learning: Supervised, Unsupervised and Reinforcement learning. Artificial

Neural Networks (ANNs): Concept, Feed forward and Feedback ANNs, Error Back Propagation, Boltzmann Machine.

Unit V Robotics 08 Hours

Robotics: Fundamentals, path Planning for Point Robot, Sensing and mapping for Point Robot, Mobile Robot Hardware, Non Visual Sensors like: Contact Sensors, Inertial Sensors, Infrared Sensors, Sonar, Radar, laser Rangefinders, Biological Sensing. Robot System Control: Horizontal and Vertical Decomposition, Hybrid Control Architectures, Middleware, High-Level Control, Human-Robot Interface.

Unit VI Robots in Practice 08 Hours

Robot Pose Maintenance and Localization: Simple Landmark Measurement, Servo Control, Recursive Filtering, Global Localization. Mapping: Sensorial Maps, Topological Maps, Geometric Maps, Exploration. Robots in Practice: Delivery Robots, Intelligent Vehicles, Mining Automation, Space Robotics, Autonomous Aircrafts, Agriculture, Forestry, Domestic Robots.

Books:

Text:

1. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education(India), 2013, ISBN : 978-1-25-902998-1
2. Elaine Rich, Kevin Knight and Nair, "Artificial Intelligence", TMH, ISBN-978-0-07- 008770-5
3. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Third edition, Pearson, 2003, ISBN :10: 0136042597
4. Michael Jenkin, Gregory, " Computational Principals of Mobile Robotics", Cambridge University Press, 2010, ISBN : 978-0-52-187157-0

References:

1. Nilsson Nils J , "Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4
2. Patrick Henry Winston, "Artificial Intelligence", Addison-Wesley Publishing Company, ISBN: 0-201-53377-4
3. Andries P. Engelbrecht-Computational Intelligence: An Introduction, 2nd Edition-Wiley India- ISBN: 978-0-470-51250-0

Software Testing and Quality Assurance

Elective II

410245(B): Software Testing and Quality Assurance

Credit 03

Unit I Introduction 08 Hours

Introduction, historical perspective, Definition, Core Components, Quality View, Financial Aspect, Customers suppliers and process, Total Quality Management(TQM), Quality practices of TQM, Quality Management through- Statistical process Control, Cultural Changes, Continual Improvement cycle, quality in different areas, Benchmarking and metrics, Problem Solving Techniques, Problem Solving Software Tools.

Software Quality- Introduction, Constraints of Software product Quality assessment, Customer is a King, Quality and Productivity Relationship, Requirements of Product, Organization Culture, Characteristics of Software, Software Development Process, Types of Product, Criticality Definitions, Problematic areas of SDLC, Software Quality Management, Why Software has defects, Processes related to Software Quality, Quality Management System's Structure, Pillars of Quality Management System, Important aspects of quality management.

Unit II Test Planning and Management 08 Hours

Review of Fundamentals of Software Testing, Testing during development life cycle, Requirement Traceability matrix, essentials, Work bench, Important Features of Testing Process, Misconceptions, Principles, salient and policy of Software testing, Test Strategy, Test Planning, Testing Process and number of defects found, Test team efficiency, Mutation testing, challenges, test team approach, Process problem faced, Cost aspect, establishing testing policy, methods, structured approach, categories of defect, Defect/ error/ mistake in software, Developing Test Strategy and Plan, Testing process, Attitude towards testing, approaches, challenges, Raising management awareness for testing, skills required by tester.

Unit III Software Test Automation 08 Hours

What is Test Automation, Terms used in automation, Skills needed for automation, What to automate, scope of automation, Design and Architecture of automation, Generic requirement for Test Tool, Process Model for Automation, Selecting Test Tool, Automation for

XP/Agile model, Challenges in Automation, Data-driven Testing.
Automation Tools like JUnit, Jmeter

Unit IV Selenium Tool 08 Hours

Introducing Selenium, Brief History of The Selenium Project, Selenium's Tool Suite, Selenium- IDE, Selenium RC, Selenium WebDriver, Selenium Grid, Test Design Considerations

Unit V Quality Management 08 Hours

Software Quality, Software Quality Dilemma, Achieving Software Quality, Software Quality Assurance. Elements of SQA, SQA Tasks, Goals, and Metrics, Formal Approaches to SQA, Statistical Software Quality Assurance, Six Sigma for Software Engineering, ISO 9000 Quality Standards, SQA Plan.

Unit VI Software Quality Tools 08 Hours

Total Quality Management, Product Quality Metrics, In process Quality Metrics, Software maintenance, Ishikawa's 7 basic tools, Checklists, Pareto diagrams, Histogram, Run Charts, Scatter diagrams, Control chart, Cause Effect diagram. Defect Removal Effectiveness and Process Maturity Level.

Books:

Text:

1. M G Limaye, "Software Testing Principles, Techniques and Tools", Tata McGraw Hill, ISBN: 9780070139909 0070139903
2. Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10: 817758121X

References:

1. Naresh Chauhan, "Software Testing Principles and Practices ", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847
2. Stephen Kan, "Metrics and Models in Software Quality Engineering", Pearson, ISBN-10: 0133988082; ISBN-13: 978-0133988086

Data Mining and Warehousing

Elective I

410244(D): Data Mining and Warehousing

Credit 03

Unit I Introduction 08 Hours

Data Mining, Data Mining Task Primitives, Data: Data, Information and Knowledge; Attribute Types: Nominal, Binary, Ordinal and Numeric attributes, Discrete versus Continuous Attributes; Introduction to Data Preprocessing, Data Cleaning: Missing values, Noisy data; Data integration: Correlation analysis; transformation: Min-max normalization, z-score normalization and decimal scaling; data reduction: Data Cube Aggregation, Attribute Subset Selection, sampling; and Data Discretization: Binning, Histogram Analysis

Unit II Data Warehouse 08 Hours

Data Warehouse, Operational Database Systems and Data Warehouses(OLTP Vs OLAP), A Multidimensional Data Model: Data Cubes, Stars, Snowflakes, and Fact Constellations Schemas; OLAP Operations in the Multidimensional Data Model, Concept Hierarchies, Data Warehouse Architecture, The Process of Data Warehouse Design, A three-tier data warehousing architecture, Types of OLAP Servers: ROLAP versus MOLAP versus HOLAP.

Unit III Measuring Data Similarity and Dissimilarity 08 Hours

Measuring Data Similarity and Dissimilarity, Proximity Measures for Nominal Attributes and Binary Attributes, interval scaled; Dissimilarity of Numeric Data: Minkowski Distance, Euclidean distance and Manhattan distance; Proximity Measures for Categorical, Ordinal Attributes, Ratio scaled variables; Dissimilarity for Attributes of Mixed Types, Cosine Similarity.

Unit IV Association Rules Mining 08 Hours

Market basket Analysis, Frequent item set, Closed item set, Association Rules, a-priori Algorithm, Generating Association Rules from Frequent Item sets, Improving the Efficiency of a-priori, Mining Frequent Item sets without Candidate Generation: FP Growth Algorithm; Mining Various Kinds of Association Rules: Mining multilevel association rules, constraint based association rule mining, Meta rule-Guided Mining of Association Rules.

Unit V Classification 08 Hours

Introduction to: Classification and Regression for Predictive Analysis, Decision Tree Induction, Rule-Based Classification: using IF-THEN Rules for Classification, Rule Induction Using a Sequential Covering Algorithm. Bayesian Belief Networks, Training Bayesian Belief Networks, Classification Using Frequent Patterns, Associative Classification, Lazy Learners-k-Nearest- Neighbor Classifiers, Case-

Based Reasoning.

Unit VI Multiclass Classification 08 Hours

Multiclass Classification, Semi-Supervised Classification, Reinforcement learning, Systematic Learning, Wholistic learning and multi-perspective learning. Metrics for Evaluating Classifier Performance: Accuracy, Error Rate, precision, Recall, Sensitivity, Specificity; Evaluating the Accuracy of a Classifier: Holdout Method, Random Sub sampling and Cross-Validation.

Books:

Text:

1. Han, Jiawei Kamber, Micheline Pei and Jian, "Data Mining: Concepts and Techniques", Elsevier Publishers, ISBN:9780123814791, 9780123814807.
2. Parag Kulkarni, "Reinforcement and Systemic Machine Learning for Decision Making" by Wiley-IEEE Press, ISBN: 978-0-470-91999-6

References:

1. Matthew A. Russell, "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More" , Shroff Publishers, 2nd Edition, ISBN: 9780596006068
2. Maksim Tsvetovat, Alexander Kouznetsov, "Social Network Analysis for Startups: Finding connections on the social web", Shroff Publishers , ISBN: 10: 1449306462

Data Analytics

410243: Data Analytics

Credit 03

Unit I Introduction and Life Cycle 08 Hours

Introduction: Big data overview, state of the practice in Analytics- BI Vs Data Science, Current Analytical Architecture, drivers of Big Data, Emerging Big Data Ecosystem and new approach. Data Analytic Life Cycle: Overview, phase 1- Discovery, Phase 2- Data preparation, Phase 3- Model Planning, Phase 4- Model Building, Phase 5- Communicate Results, Phase 6- Opearationalize. Case Study: GINA

Unit II Basic Data Analytic Methods 08 Hours

Statistical Methods for Evaluation- Hypothesis testing, difference of means, wilcoxon rank-sum test, type 1 type 2 errors, power and sample size, ANNOVA. Advanced Analytical Theory and Methods:

Clustering- Overview, K means- Use cases, Overview of methods, determining number of clusters, diagnostics, reasons to choose and cautions.

Unit III Association Rules and Regression 08 Hours

Advanced Analytical Theory and Methods: Association Rules- Overview, a-priori algorithm, evaluation of candidate rules, case study-transactions in grocery store, validation and testing, diagnostics. Regression- linear, logistics, reasons to choose and cautions, additional regression models.

Unit IV Classification 08 Hours

Decision trees- Overview, general algorithm, decision tree algorithm, evaluating a decision tree. Naïve Bayes - Bayes? Algorithm, Naïve Bayes? Classifier, smoothing, diagnostics. Diagnostics of classifiers, additional classification methods.

Unit V Big Data Visualization 08 Hours

Introduction to Data visualization, Challenges to Big data visualization, Conventional data visualization tools, Techniques for visual data representations, Types of data visualization, Visualizing Big Data, Tools used in data visualization, Analytical techniques used in Big data visualization.

Unit VI Advanced Analytics-Technology and Tools 08 Hours

Analytics for unstructured data- Use cases, Map Reduce, Apache Hadoop. The Hadoop Ecosystem- Pig, HIVE, HBase, Mahout, NoSQL. An Analytics Project-Communicating, operationalizing, creating final deliverables.

Books:

Text:

1. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publications, 2012, ISBN0-07-120413-X
2. Ashutosh Nandeshwar , "Tableau Data Visualization Codebook", Packt Publishing, ISBN 978-1-84968-978-6

References:

1. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hill, ISBN: 789353160258.
2. Mark Gardner, "Beginning R: The Statistical Programming Language", Wrox Publication, ISBN: 978-1-118-16430-3

3. Luís Torgo, "Data Mining with R, Learning with Case Studies", CRC Press, Talay and Francis Group, ISBN9781482234893

4. Carlo Verrellis, "Business Intelligence - Data Mining and Optimization for Decision Making", Wiley Publications, ISBN: 9780470753866.

High Performance Computing

410241: High Performance Computing

Credit 04

Unit I Introduction 09 Hours

Motivating Parallelism, Scope of Parallel Computing, Parallel Programming Platforms: Implicit Parallelism, Trends in Microprocessor and Architectures, Limitations of Memory, System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Scalable design principles, Architectures: N-wide superscalar architectures, Multi-core architecture.

Unit II Parallel Programming 09 Hours

Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, The Age of Parallel Processing, the Rise of GPU Computing, A Brief History of GPUs, Early GPU.

Unit III Basic Communication 09 Hours

Operations- One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations.

Unit IV Analytical Models of Parallel Programs 09 Hours

Analytical Models: Sources of overhead in Parallel Programs, Performance Metrics for Parallel Systems, and The effect of Granularity on Performance, Scalability of Parallel Systems, Minimum execution time and minimum cost, optimal execution time. Dense Matrix Algorithms: Matrix- Vector Multiplication, Matrix-Matrix Multiplication.

Unit V Parallel Algorithms- Sorting and Graph 09 Hours

Issues in Sorting on Parallel Computers, Bubble Sort and its Variants, Parallelizing Quick sort, All-Pairs Shortest Paths, Algorithm for sparse graph, Parallel Depth-First Search, Parallel Best- First Search.

Unit VI CUDA Architecture 09 Hours

CUDA Architecture, Using the CUDA Architecture, Applications of CUDA Introduction to CUDA C-Write and launch CUDA C kernels, Manage GPU memory, Manage communication and synchronization, Parallel programming in CUDA- C.

Books:

Text:

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2
2. Jason sanders, Edward Kandrot, "CUDA by Example", Addison-Wesley, ISBN-13: 978-0- 13-138768-3

References:

1. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998, ISBN:0070317984
2. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884
3. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufmann,1999, ISBN 978-1-55860-343-1
4. Rod Stephens, " Essential Algorithms", Wiley, ISBN: 978-1-118-61210-1

Pervasive and Ubiquitous Computing

Elective I

410244(C): Pervasive and Ubiquitous Computing

Credit 03

Unit I Pervasive Computing 08 Hours

Pervasive Computing, Applications, Pervasive Computing devices and Interfaces, Device technology trends, Connecting issues and protocols. Pervasive Computing- Principles, Characteristics, interaction transparency, context aware, automated experience

capture. Architecture for pervasive computing.

Unit II Open Protocols 08 Hours

Open protocols, Service discovery technologies- SDP, Jini, SLP, UpnP protocols, data Synchronization, SyncML framework, Context aware mobile services, Context aware sensor networks, addressing and communications- Context aware security. Pervasive Computing and web based Applications - XML and its role in Pervasive Computing, Wireless Application Protocol (WAP) Architecture and Security, Wireless Mark-Up language (WML) - Introduction. Moving on from Weiser's Vision of Calm Computing: Engaging UbiComp Experiences.

Unit III Voice Enabled Pervasive Computing 08 Hours

Voice Enabled Pervasive Computing, Voice Standards, Speech Applications in Pervasive Computing and security. Device Connectivity, Web application Concepts, WAP and Beyond. Voice Technology - Basis of speech Recognition, Voice Standards, Speech Applications, Speech and Pervasive Computing, Security, The Hitchhiker's Guide to UbiComp: Using techniques from Literary and Critical Theory to Reframe Scientific Agendas.

Unit IV Personal Digital Assistant 08 Hours

Personal Digital Assistant - History, Device Categories, Device Characteristics, Software Components, Standards. Server side programming in Java, Pervasive Web application Architecture, Example Application, Access via PCs, Access via WAP, Access via PDA, and Access via Voice, Pinch Watch: A Wearable Device for One-Handed Micro interactions., Interfaces - Enabling mobile micro-interactions with physiological computing.

Unit V User Interface 08 Hours

User Interface Issues in Pervasive Computing, Architecture, and Smart Card based Authentication Mechanisms, Wearable computing Architecture. Touche: Enhancing Touch Interaction on Humans, Screens, Liquids, and Everyday Objects

Unit VI Context Awareness and Application Development 08 Hours

Location as context, Location Tracking, Co-ordinate models, Location Data Sources, sorting and search in location data. Sensing Activity based on various wearable sensors, smart phone sensors. Wearable Computing applications in Healthcare and Assistive Technologies. Developing, Deploying and Evaluating Pervasive computing

applications. Application in Augmented Reality.

Books:

Text:

1. Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaec and Klaus Rindtorff, "Pervasive Computing Technology and Architecture of Mobile Internet Applications", Addison Wesley, 2002. ISBN:13: 978-0-201-72215-4
2. Uwe Hansman, Lothar Merk, Martin S Nicklous and Thomas Stober: "Principles of Mobile Computing", Second Edition, Springer-Verlag, New Delhi, 2003, ISBN: 9783662043189

References:

1. Mohammads, Obaidait, Denko, Woungang, "Pervasive Computing and Networking", Wiley, ISBN:978-0-470-74772-8
2. Seng Loke, "Context-Aware Computing Pervasive Systems", Auerbach Pub., New York, 2007, ISBN: 978-1-4471-5006-0
3. Uwe Hansmann etl, "Pervasive Computing", Springer, New York,2001., ISBN: 10: 3540002189
4. John Krumm, "Ubiquitous Computing Fundamentals", Shroff Publishers, ISBN: 9781420093605
5. Adelstein, "Fundamental of Mobile and Pervasive Computing", McGrawHill, ISBN: 0-07- 141237-9

Mobile Communication

Elective II

410245(D): Mobile Communication

Credit 03

Unit I Introduction to Cellular Networks 08 Hours

Cell phone generation-1G to 5G, Personal Communication System (PCS), PCS Architecture, Mobile Station,, SIM, Base Station, Base Station Controller, Mobile Switching Center, MSC Gateways, HLR and VLR, AuC/EIR/OSS, Radio Spectrum, Free Space Path Loss, S/N Ratio, Line of sight transmission, Length of Antenna, Fading in Mobile Environment.

Unit II Cellular Network Design 08 Hours

Performance Criterion, Handoff/Hanover, Frequency Reuse, Co-channel Interference and System Capacity, Channel Planning, Cell Splitting, Mobility Management in GSM and CDMA.

Unit III Medium Access Control 08 Hours

Specialized MAC, SDMA, FDMA, TDMA, CDMA, Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS), GMSK Modulation, 8PSK, 64 QAM, 128 QAM and OFDM

Unit IV GSM 08 Hours

GSM - Architecture, GSM Identifiers, Spectrum allocation, Physical and Logical Traffic and Control channels, GSM Bursts, GSM Frame, GSM Speech Encoding and decoding, Location Update, Incoming and Outgoing Call setup, GPRS.

Unit V Current 3G and 4G Technologies for GSM and CDMA 08 Hours

EDGE, W-CDMA: Wideband CDMA, CDMA2000, UMTS, HSPA (High Speed Packet Access), HSDPA, HSUPA, HSPA+, LTE (E-UTRA) 3GPP2 family CDMA2000 1x, 1xRTT, EV-DO (Evolution-Data Optimized), Long Term Evolution (LTE) in 4G.

Unit VI Advances in Mobile Technologies 08 Hours

5GAA (Autonomous Automation), Millimetre Wave, URLLC, LTEA (Advanced), LTE based MULTIFIRE, Virtual Reality, Augmented Reality.

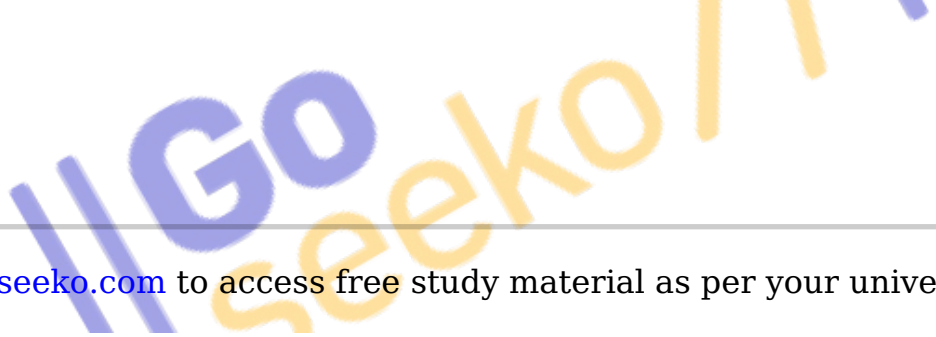
Books:

Text:

1. Jochen Schiller, "Mobile Communications", Pearson Education, Second Edition, 2004, ISBN: 13: 978-8131724262
2. Jason Yi-Bing Lin, Yi-Bing Lin, Imrich Chlamtac, "Wireless and Mobile network Architecture", 2005, Wiley Publication, ISBN: 978812651560
3. Martin Sauter, "3G, 4G and Beyond: Bringing Networks, Devices and the Web Together", 2012, ISBN-13: 978-1118341483

References:

1. Theodore S Rappaport, "Wireless Communications - Principles and Practice" , Pearson Education India, Second Edition, 2010, ISBN: 978-81-317-3186-4
2. Lee and Kappal, "Mobile Communication Engineering", Mc Graw Hill, ISBN:
3. William Stallings, "Wireless Communication and Networks", Prentice Hall, Second Edition, 2014, ISBN: 978-0131918351



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