# DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW, UTTAR PRADESH

## EVALUATION SCHEME & SYLLABUS

## FOR

## B. TECH. 4TH YEAR

- **Computer Science**
- **Computer Engineering**
- **Computer Science and Engineering**

**Based On**

**National Education Policy (NEP2020)** राष्ट्रीय शिक्षा नीति -2020

**(Effective from the Session: 2025-26)**

# B. TECH (COMPUTER SCIENCE & ENGINEERING/ COMPUTER SCIENCE/CE) CURRICULUM STRUCTURE

| | | SEMESTER- VII | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S. No. | Code | Subject | Learning Mode | LTP | | | Evaluation Scheme | | | | | | Total | Credit |
| | | | | L | T | P | CT | TA | Total | PS | TE | PE | | |
| 1 | BCS701 | Artificial Intelligence | Offline | 3 | - | - | 20 | 10 | 30 | - | 70 | - | 100 | 3 |
| 2 | Departmental Elective-IV | Departmental Elective-IV | Offline | 3 | - | - | 20 | 10 | 30 | - | 70 | - | 100 | 3 |
| 3 | BOEM** | Open Elective-II | Offline/ MOOCs | 3 | 0 | 0 | 20 | 10 | 30 | - | 70 | - | 100 | 3 |
| 4 | BCS751 | Artificial Intelligence LAB | Offline | 0 | 0 | 2 | - | - | - | 50 | - | 50 | 100 | 1 |
| 5 | BCS752 | Mini Project or Internship Assessment* | | 0 | 0 | 4 | - | - | - | 100 | - | - | 100 | 2 |
| 6 | BCS753 | Project-I | | 0 | 0 | 10 | - | - | - | 150 | - | - | 150 | 5 |
| 7 | BCS754 | Startup and Entrepreneurial Activity Assessment# | | 0 | 0 | 4 | - | - | - | 100 | - | - | 100 | 2 |
| | | **Total** | | **9** | **0** | **20** | | | | | | | **750** | **19** |
| | | *The Mini Project or internship (5-6 weeks) conducted during summer break after VI semester and will be assessed during VII semester.<br>#The Startup and Entrepreneurial Activity Assessment will be done in 7th semester under which a student will have to undergo a startup/entrepreneurship activity of at least 60 hours till 6th semester | | | | | | | | | | | | |

| | | SEMESTER- VIII | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S. No | Code | Subject | Learning Mode | Periods | | | Evaluation Scheme | | | | | | Total | Credit |
| | | | | L | T | P | CT | TA | Total | PS | TE | PE | | |
| 1 | BOEM** | Open Elective-III | MOOCs | 3 | 0 | 0 | 20 | 10 | 30 | | 70 | | 100 | 3 |
| 2 | BOEM** | Open Elective-IV | MOOCs | 3 | 0 | 0 | 20 | 10 | 30 | | 70 | | 100 | 3 |
| 3 | BCS851 | Project-II | | 0 | 0 | 18 | | | | 100 | | 350 | 450 | 10 |
| | | **Total** | | **6** | **0** | **18** | **24** | | | | | | **650** | **16** |

*The Internal Assessment of MOOCs will be done by the respective institute and the External Assessment (End Semester Examination) will be done by the University.*

## Departmental Elective- IV

1. BCS070 Internet of Things
2. BCS071 Cloud Computing
3. BCS072 Cryptography and Network Security
4. BCS073 Design & Development of Applications

## B.TECH. (CSE/CS/CE)

## SEVENTH SEMESTER (DETAILED SYLLABUS)

| **Artificial Intelligence (BCS701)** | | |
|---|---|---|
| **Course Outcome (CO)** | | **Bloom's Knowledge Level (KL)** |
| **At the end of course, the student will be able to understand** | | |
| CO 1 | Understand the fundamentals of Artificial Intelligence, intelligent agents, and various approaches to problem-solving in AI. | K2 |
| CO 2 | Apply uninformed and informed search strategies, heuristics, and optimization techniques to solve classical AI problems and games. | K3 |
| CO 3 | implement logical reasoning techniques using propositional and first-order logic, including inference strategies and knowledge representation methods. | K4 |
| CO 4 | Analyze uncertainty in knowledge representation using probabilistic reasoning, fuzzy logic, and basic neural network concepts. | K4 |
| CO 5 | Evaluate and demonstrate AI applications in areas such as natural language processing (NLP), robotics, multi-agent systems, and Explainable AI (XAI) through real-world problem examples. | K5 |

| **DETAILED SYLLABUS** | | **3-0-0** |
|---|---|---|
| **Unit** | **Topic** | **Proposed Lecture** |
| **I** | **Introduction to Artificial Intelligence & Intelligent Agents:** Definition and scope of AI, History and applications of AI, Characteristics of Intelligent Agents, Types of agents and environments, Agent architecture, Problem Solving Approach to Typical AI problems, Problem-solving agents. Example problems and approaches. | **08** |
| **II** | **Problem Solving & Search Strategies:** Uninformed Search Strategies: BFS, DFS, Iterative Deepening, Informed Search Strategies: Greedy Best-First Search, A* Search, Heuristics and Optimization, Hill Climbing, Simulated Annealing, Constraint Satisfaction Problems, Game Playing: Min-max, Alpha-Beta Pruning, Stochastic & Partially Observable Games. | **08** |
| **III** | **Knowledge Representation & Reasoning:** Propositional and First Order Logic, Syntax, Semantics, and Inference, Knowledge-based agents: Wumpus world, Logic Programming using Prolog, Forward and Backward Chaining, Resolution, Ontological Engineering and Reasoning. | **08** |
| **IV** | **Uncertainty & Learning Techniques:** Introduction to uncertainty and probabilistic reasoning, Bayes' Rule, Bayesian Networks, Fuzzy logic and handling imprecision, Neural Networks (basics only): Perceptron, Backpropagation (intro level), Fundamentals of Machine Learning in AI context, Introduction to supervised and unsupervised learning. | **08** |
| **V** | **Applications of AI & Multi-Agent Systems:** Natural Language Processing, Machine Translation, Information Retrieval and Extraction, Robotics: Perception, Planning, and Motion, Speech Recognition, Software Agents: Architecture, Communication, Trust, Multi-agent Negotiation and Reputation. **Explainable AI (XAI)** – Importance of interpretability, techniques for explaining black-box models, trust in AI, case studies in NLP and vision. | **08** |

**RecommendedTextbooks:**

1. Stuart Russell & Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson, 2022
2. Ivan Bratko, *Prolog: Programming for Artificial Intelligence*, 4th Edition, Addison-Wesley
3. Nils J. Nilsson, *The Quest for Artificial Intelligence*, Cambridge University Press
4. David Poole & Alan Mackworth, *Artificial Intelligence: Foundations of Computational Agents*, Cambridge Press

| Internet of Things (BCS070) | | |
|---|---|---|
| **Course Outcome (CO)** | | **Bloom's Knowledge Level (KL)** |
| **At the end of course, the student will be able to understand** | | |
| CO 1 | Describe the basic concepts, principles and challenges in IoT. | K2 |
| CO 2 | Illustrate functioning of hardware devices and sensors used for IoT. | K2 |
| CO 3 | Analyze network communication aspects and protocols used in IoT. | K4 |
| CO 4 | Apply IoT for developing real life applications using Ardunio programming. | K3 |
| CP 5 | To develop IoT infrastructure for popular applications | $K_2$, $K_3$ |

| **DETAILED SYLLABUS** | | **3-1-0** |
|---|---|---|
| **Unit** | **Topic** | **Proposed Lecture** |
| **I** | **Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability | **08** |
| **II** | **Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex. | **08** |
| **III** | **Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination | **08** |
| **IV** | **Programming the Ardunio:** Ardunio Platform Boards Anatomy, Ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT. | **08** |
| **V** | **Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city. | **08** |

**Text books:**


1. Olivier Hersent,David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", wiley
2. Jeeva Jose, Internet of Things, Khanna Publishing House
3. Michael Miller "The Internet of Things" by Pearson
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
5. ArshdeepBahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications,2014
6. Adrian McEwen,Hakin Cassimally "Designing the Internet of Things" Wiley India

| Cloud Computing (BCS071) | | |
|---|---|---|
| **Course Outcome (CO)** | | **Bloom's Knowledge Level (KL)** |
| **At the end of course, the student will be able to understand** | | |
| CO 1 | Describe architecture and underlying principles of cloud computing. | K3 |
| CO 2 | Explain need, types and tools of Virtualization for cloud. | K2 |
| CO 3 | Describe Services Oriented Architecture and various types of cloud services. | K2 |
| CO 4 | Explain Inter cloud resources management cloud storage services and their providers Assess security services and standards for cloud computing. | K2 |
| CO 5 | Analyze advanced cloud technologies. | K6 |

| **DETAILED SYLLABUS** | | **3-1-0** |
|---|---|---|
| **Unit** | **Topic** | **Proposed Lecture** |
| **I** | **Introduction To Cloud Computing:** Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On- demand Provisioning. | **08** |
| **II** | **Cloud Enabling Technologies Service Oriented Architecture:** REST and Systems of Systems – Web Services – Publish, Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery. | **08** |
| **III** | **Cloud Architecture, Services And Storage:** Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3. | **08** |
| **IV** | **Resource Management And Security In Cloud:** Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards. | **08** |
| **V** | **Cloud Technologies And Advancements Hadoop:** MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation. | **08** |

**Text books:**


1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.
5. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

| Cryptography & Network Security (BCS072) | | |
|---|---|---|
| **Course Outcome (CO)** | | **Bloom's Knowledge Level (KL)** |
| **At the end of course, the student will be able to:** | | |
| CO 1 | Classify the symmetric encryption techniques and Illustrate various Public key cryptographic techniques. | K2 |
| CO 2 | Understand security protocols for protecting data on networks and be able to digitally sign emails and files. | K1 |
| CO 3 | Understand vulnerability assessments and the weakness of using passwords for authentication | K4 |
| CO 4 | Be able to perform simple vulnerability assessments and password audits | K3 |
| CO 5 | Summarize the intrusion detection and its solutions to overcome the attacks. | K2 |

| **DETAILED SYLLABUS** | | **3-0-0** |
|---|---|---|
| **Unit** | **Topic** | **Proposed Lecture** |
| **I** | Introduction to security attacks, services and mechanism, Classical encryption techniques-substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers. Modern Block Ciphers: Block ciphers principles, Shannon's theory of confusion and diffusion, fiestal structure, Data encryption standard(DES), Strength of DES, Idea of differential cryptanalysis, block cipher modes of operations, Triple DES | **08** |
| **II** | Introduction to group, field, finite field of the form GF(p), modular arithmetic, prime and relative prime numbers, Extended Euclidean Algorithm, Advanced Encryption Standard (AES) encryption and decryptionFermat's and Euler's theorem, Primarily testing, Chinese Remainder theorem, Discrete Logarithmic Problem,Principals of public key crypto systems, RSA algorithm, security of RSA | **08** |
| **III** | Message Authentication Codes: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions, Secure hash algorithm (SHA) Digital Signatures: Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS), proof of digital signature algorithm, | **08** |
| **IV** | Key Management and distribution: Symmetric key distribution, Diffie-Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure. Authentication Applications: Kerberos, Electronic mail security: pretty good privacy (PGP), S/MIME. | **08** |
| **V** | IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Introduction to Secure Socket Layer, Secure electronic, transaction (SET) System Security: Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls | **08** |

**Text books:**

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson Education.
2. Behrouz A. Frouzan: Cryptography and Network Security, McGraw Hill .
3. C K Shyamala, N Harini, Dr. T.R.Padmnabhan Cryptography and Security ,Wiley
4. Bruce Schiener, "Applied Cryptography". John Wiley & Sons
5. Bernard Menezes," Network Security and Cryptography", Cengage Learning.
6. AtulKahate, "Cryptography and Network Security", McGraw Hill

| Design & Development of Applications (BCS073) | | |
|---|---|---|
| **Course Outcome (CO)** | | **Bloom's Knowledge Level (KL)** |
| **At the end of course, the student will be able to:** | | |
| CO 1 | Be exposed to technology and business trends impacting mobile applications | K2 |
| CO 2 | Be competent with the characterization and architecture of mobile applications. | K3 |
| CO 3 | Be competent with understanding enterprise scale requirements of mobile applications. | K2 |
| CO 4 | Be competent with designing and developing mobile applications using one application development framework. | K3 |
| CO 5 | Be exposed to Android and iOS platforms to develop the mobile applications | K2 |

| **DETAILED SYLLABUS** | | **3-0-0** |
|---|---|---|
| **Unit** | **Topic** | **Proposed Lecture** |
| **I** | **INTRODUCTION:** Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications | **08** |
| **II** | **BASIC DESIGN:** Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability | **08** |
| **III** | **ADVANCED DESIGN:** Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications. | **08** |
| **IV** | TECHNOLOGY I – ANDROID: Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wi-Fi – Integration with social media applications. | **08** |
| **V** | TECHNOLOGY II –iOS: Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wi-Fi - iPhone marketplace. Swift: Introduction to Swift, features of swift | **08** |

**Text books:**


1. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012
2. AnubhavPradhan , Anil V Despande Composing Mobile Apps,Learn ,explore,apply
3. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012
4. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
5. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS
6. Development: Exploring the iOS SDK", Apress, 2013.

| **BCS751 ARTIFICIAL INTELLIGENCE LAB** | | |
|---|---|---|
| **Course Outcome (CO)** | | **Bloom's Knowledge Level (KL)** |
| **At the end of course, the student will be able to** | | |
| CO 1 | Understand and apply basic search algorithms and intelligent problem-solving approaches in Python. | K2 |
| CO 2 | Design and implement logic-based knowledge representations and reasoning using Python and Prolog. | K3 |
| CO 3 | Use Natural Language Toolkit (NLTK) for basic NLP tasks like stemming, tagging, and classification. | K3 |
| CO 4 | Analyze and implement basic AI game strategies like Minimax and Alpha-Beta pruning. | K4 |
| CO 5 | Demonstrate AI techniques in real-world tasks such as text processing, planning, or constraint satisfaction. | K4 |

**DETAILED SYLLABUS**

1. **Implement Breadth First Search (BFS)** for a given graph or maze.
2. **Implement Depth First Search (DFS)** for a tree or graph structure.
3. **Solve the 8-Puzzle Problem** using A* Search Algorithm.
4. **Implement Hill Climbing Algorithm** for numerical optimization or pathfinding.
5. **Implement Simulated Annealing Algorithm** for constraint-based search problems.
6. **Solve Water Jug Problem** using state-space search (BFS or DFS).
7. **Write Prolog programs** to define family relationships using predicates.
8. **Implement 4-Queens Problem** in Prolog using backtracking.
9. **Implement Unification Algorithm** in Python or Prolog.
10. **Implement Forward and Backward Chaining** in a rule-based system (manual or code-based).
11. **Demonstrate Resolution in Propositional Logic** through a basic example (e.g., proving a theorem).
12. **Remove punctuation and stop words** from a paragraph using nltk.
13. **Perform stemming and lemmatization** on user-input text.
14. **Apply POS (Part of Speech) tagging** using NLTK on a given sentence.
15. **Build a simple text classifier** using NLTK (e.g., classify messages as spam/ham).
16. **Implement Tic-Tac-Toe game** with a basic AI opponent.
17. **Implement Min-Max (Minimax) Algorithm** for decision making in turn-based games.
18. **Enhance the game with Alpha-Beta Pruning** to optimize Min-Max.
19. **Simulate a Vacuum Cleaner Agent** that intelligently cleans a 2D environment.
20. **Build a simple chatbot** using rules or pre-trained logic (can use regex or basic intent matching).
21. **Design a Constraint Satisfaction Problem solver**, e.g., Sudoku, or Map Coloring.
22. **Perform simple Bayesian reasoning** for a probability-based decision problem (e.g., medical diagnosis).

**Instructions to the Instructor:**

1. The instructor may **add/delete/modify/tune** experiments depending on syllabus coverage and availability of tools.
2. All experiments should preferably be implemented using **Python (with NLTK and standard libraries)** and **SWI-Prolog** for logic programming tasks.

| Mini Project or Internship Assessment (BCS 752) | | |
|---|---|---|
| **Course Outcome (CO)** | | **Bloom's Knowledge Level (KL)** |
| **At the end of course, the student will be able to understand** | | |
| CO 1 | Developing a technical artifact requiring new technical skills and effectively utilizing a new software tool to complete a task | $K_4$ , $K_5$ |
| CO 2 | Writing requirements documentation, Selecting appropriate technologies, identifying and creating appropriate test cases for systems. | $K_5$ , $K_6$ |
| CO 3 | Demonstrating understanding of professional customs & practices and working with professional standards. | $K_4$ , $K_5$ |
| CO 4 | Improving problem-solving, critical thinking skills and report writing. | $K_4$ , $K_5$ |
| CO 5 | Learning professional skills like exercising leadership, behaving professionally, behaving ethically, listening effectively, participating as a member of a team, developing appropriate workplace attitudes. | $K_2$, $K_4$ |

| Project (BCS 753 , BCS 851) | | |
|---|---|---|
| **Course Outcome ( CO)** | | **Bloom's Knowledge Level (KL)** |
| **At the end of course , the student will be able to understand** | | |
| CO 1 | Analyze and understand the real life problem and apply their knowledge to get programming solution. | $K_4$ , $K_5$ |
| CO 2 | Engage in the creative design process through the integration and application of diverse technical knowledge and expertise to meet customer needs and address social issues. | $K_4$ , $K_5$ |
| CO 3 | Use the various tools and techniques, coding practices for developing real life solution to the problem. | $K_5$ , $K_6$ |
| CO 4 | Find out the errors in software solutions and establishing the process to design maintainable software applications | $K_4$ , $K_5$ |
| CO 5 | Write the report about what they are doing in project and learning the team working skills | $K_5$, $K_6$ |