



**Progressive Education Society's
Modern College Of Arts, Science & Commerce
(Autonomous)**

Ganeshkhind, Pune – 411016

**Three Year Degree Program in B.C.A.(Science)
(Faculty of Science & Technology)**

T.Y.B.C.A. (Science)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2024-2025

Title of the Course: Bachelor of Computer Applications (Science)

Preamble of the syllabus

The B.C.A. (Science) program is a combination of computer and applied courses from science stream. The computer related courses introduce techniques of programming, databases, web designing, system analysis, design tools and different computing environments. The applied courses include mathematics, statistics and electronics that provide theoretical and practical foundation for the learner.

Objectives:

- To produce knowledgeable and skilled human resources that is employable in IT and ITeS.
- To impart knowledge required for planning, designing and building Complex Application Software Systems as well as to provide support for automated systems or applications.
- It helps students analyse the requirements for system development and exposes students to business software and information systems.
- This course provides students with options to specialize in legacy application software, system software or mobile applications.
- To produce entrepreneurs

Introduction

The Program is of Three Years duration with six semesters. It is a Full Time Degree Program. The program will be based on Choice-based credit system comprising 132+8 (140) credit points.

Suggested internal assessment tools for courses:

The concerned teacher shall announce the units for which internal assessment will take place. A teacher may choose one of the methods given below for the assessment.

1. Library notes
2. Students Seminar
3. Short Quizzes / MCQ Test
4. Home Assignments
5. Tutorials/ Practical
6. Oral test
7. Research Project
8. Group Discussion
9. Open Book Test
10. Written Test
11. PPT presentation
12. Industrial Visit
13. Viva

Teaching Methodology:

1. Classroom Teaching

2. Guest Lectures
3. Group Discussions
4. Surveys
5. Power Point Presentations
6. Visit to Industries
7. Research Papers & Projects
8. E-content

Eligibility:

Any candidate who has passed the XII standard Examination in Science stream from, Maharashtra State Board of Secondary and Higher Secondary Education or equivalent Board of Examination, is eligible for admission to the First Year of this program.

OR

Passed Three Year Diploma Course approved by the DTE, Maharashtra State or Equivalent authority.

Semester -V T.Y. B.C.A (Science)						
Course Code	Course Title	Credits		Evaluation		
		T	P	CIA	CE	Total
24-BCA-351	Advanced Java	4	-	30	70	100
24-BCA-352	Data Mining and Data Science	4	-	30	70	100
24-BCA-353	Operating Systems	4	-	30	70	100
24-BCA-354	Artificial Intelligence	2	-	15	35	50
24-BCA-355	Computer Network	2	-	15	35	50
24-BCA-356	Advanced Java Laboratory	-	2	15	35	50
24-BCA-357	Data Mining and Data Science Laboratory	-	2	15	35	50
24-BCA-358	Operating Systems & AI Laboratory	-	2	15	35	50
Total		16	6	165	385	550

Total Credits: [16(TH) + 6 (PR)] = 22

TH: Theory **PR:** Practical **CIA:** Continuous Internal Assessment **CSE:** College Semester Examination

Semester -VI T.Y. B.C.A (Science)						
Course Code	Course Title	Credits		Evaluation		
		T	P	CIA	CE	Total
24-BCA-361	Android Programming	4	-	30	70	100
24-BCA-362	Programming in GO	4	-	30	70	100
24-BCA-363	Internet of Things (IoT)	4	-	30	70	100
24-BCA-364	Blockchain Technology	2	-	15	35	50
24-BCA-365	Cloud Computing	2	-	15	35	50
24-BCA-366	Android Programming Laboratory	-	2	15	35	50
24-BCA-367	Programming in GO and IoT Laboratory	-	2	15	35	50
24-BCA-368	Project Laboratory	-	2	15	35	50
Total		16	6	165	385	550

Total Credits: [16(TH) + 6 (PR)] = 22

TH: Theory **PR:** Practical **CIA:** Continuous Internal Assessment **CSE:** College Semester Examination

T.Y.B.C.A (Science)**SEMESTER V****Course Code: 24-BCA-351****Course Name: Advanced Java****Total Credits: 4****Course Objectives:**

- To understand collection classes and interfaces.
- To know the process of application development using Graphical User Interface (GUI).
- To acquire knowledge about handling databases using Java.
- To study web components for developing web applications.

Course Outcome:-

On completion of the course, student will be able to–

- Design end to end applications using object oriented constructs.
- Apply collection classes for storing java objects.
- Use Java APIs for program development.
- Handle abnormal termination of a program using exception handling.

Unit	Topic	No of lectures
1	Unit I Collection Introducing to Collections framework, List - ArrayList, LinkedList, Set - HashSet, TreeSet, Map - HashMap and TreeMap, Interfaces such as Comparator, Iterator, ListIterator, Enumeration, Exception handling- try ,catch ,finally, throw and throws,Inputs Outputs.	10 Hrs
2	Unit II Multithreading Threads and Life cycle of thread, Creating threads - Thread class , Runnable interface, Thread priorities, Running multiple threads, Synchronization and interthread communication, Thread Methods, Thread Scheduler, ThreadGroupclass	07 Hrs
3	Unit III Database Programming The role of jdbc, jdbc configuration, Types of drivers, Connectivity with database, JDBC Statements – Statement, Prepared Statement, Callable Statement, Scrollable and updatable result sets, Metadata – DatabaseMetadata,	10 Hrs

	ResultSetMetadata (Database: PostgreSQL)	
4	<p>Unit IV Servlets and JSP</p> <p>Servlets: Introduction to Servlets and Hierarchy of Servlets, Life cycle of a servlet, Tomcat configuration (Note: Only for Lab Demonstration), Handling get and post request (HTTP), Handling a data from HTML to a servlet, Session tracking – Cookies and Http Session</p> <p>JSP: Simple JSP program, Life cycle of a JSP, Implicit Objects, Scripting elements – Declarations, Expressions, Scriptlets, Comments, JSP Directives – Page Directive, include directive, Mixing Scriptlets and HTML</p>	10 Hrs
5	<p>Unit V Applet</p> <p>Applet basics, Life Cycle of an Applet, The Applet Class, Invoking an Applet, Getting Applet Parameters, Specifying Applet Parameters, Application Conversion to Applets, Event Handling Displaying Images, Playing Audio</p>	10 Hrs
6	<p>Unit VI Spring Framework</p> <p>Introduction of spring framework, Spring Modules / Architecture, Spring Applications, Spring MVC, Spring MVC Forms, Validation</p>	07 Hrs
7	<p>Unit VII Java Networking</p> <p>Java Socket Programming, Socket classes, ServerSocket classes, URL class and method of URL class, URLConnection class, methods of URLConnection class, HttpURLConnection class, HttpURLConnection class methods</p>	06 Hrs

Reference Books:

- 1) Core Java Volume I - Fundamentals By Cay S. Horstmann, 11th Edition, Prentice Hall, ISBN 978- 0-13-516630-7
- 2) The Complete Reference By Herbert Schildt, 11th Edition, McGraw Hill Education, ISBN 978-260- 44023-2
- 3) Java BeginnersGuide By Herbert Schildt, 8th Edition, McGraw-Hill Education ISBN978-1- 260- 44021-8
- 4) Core Java Volume II – Fundamentals By Cay S. Horstmann, 11th Edition, Prentice Hall, ISBN 978-013-516631-4
- 5) Java 2 Programming Black Book By Steven Holzner, DreamTech Press, ISBN 978-93-5119-953-4

T.Y.B.C.A (Science)**SEMESTER V****Course Code: 24-BCA-352****Course Name: Data Mining and Data Science****Total Credits: 4****Course Objectives:**

- Provide students with knowledge and skills for data-intensive problem solving and scientific discovery
- Be prepared with a varied range of expertise in different aspects of data science such as data collection, visualization, processing and modeling of large data sets.
- Acquire good understanding of both the theory and application of applied statistics and computer science based existing data science models to analyze huge data sets originating from diversified application areas.
- Be better trained professionals to cater the growing demand for data scientists in Industry.

Course Outcome:-

On completion of the course, student will be able to–

- Perform Exploratory Data Analysis Obtain, clean/process, and transform data.
- Detect and diagnose common data issues, such as missing values, special values, outliers, inconsistencies, and localization.
- Demonstrate proficiency with statistical analysis of data. Present results using data visualization techniques.
- Prepare data for use with a variety of statistical methods and models and recognize how the quality of the data and the means of data collection may affect conclusions

Unit	Topic	No of lectures
1	Unit I Introduction to Data Mining Definition Data mining, Data Mining issues, Stages of the Data Mining Process (KDD), Data Mining Techniques/Tasks, Knowledge Representation Methods, Applications of Data mining Data Pre-processing, Data Cleaning, Data Transformation, Data Reduction, Data Discretization	10 Hrs
2	Unit II Data Warehousing Introduction to Data Warehouse, Data Warehouse Architecture and its components, Data Modeling with OLAP- Difference between OLTP and OLAP, Data Mart, Fact Table, Dimension Table, OLAP cube, Different OLAP	08 Hrs

	Operations, Schema Design- Star and snow-Flake Schema, Introduction to Machine Learning, Introduction to Pattern Matching, Case study on schema design	
3	Unit III Classification Introduction, Definition. Decision Tree- Construction Principle, Attribute Selection Measures, Tree Pruning. Rule-Based Classification- Using IF-THEN Rules for Classification, Rule Extraction from a Decision Tree. Bayes Classification Methods- Bayes' Theorem, Naive Bayesian Classification Bayesian Networks, Parameter and structure learning, Linear classifier, Perceptron, k-Nearest- Neighbor Classifiers. SVM classifiers-Types of SVM, Working of SVM. Regression-Linear Regression, Non linear Regression. Introduction to Prediction	12 Hrs
4	Unit IV Clustering and Association Rule Mining Cluster Analysis and Requirements for Cluster Analysis, Hierarchical Methods - Agglomerative Hierarchical Clustering, Divisive Hierarchical Clustering, Partitioning Methods- k-Means: A Centroid-Based Technique k-Medoids: A Representative Object-Based Technique, Introduction to Association Rule Mining, Market Basket Analysis, Items, Itemsets and Large Itemsets, Apriori Algorithm, Kinds of Association Rules, Mining Multilevel association rules Constraint Based Association rules mining	10 Hrs
5	Unit V Introduction to Data Science Basics of Data, What is Data Science?, Data science process, Stages in a Data Science project, Applications of Data Science in various fields, Basics of Data Analytics, Types of Analytics – Descriptive, Predictive, Prescriptive, Statistical Inference - Populations and samples - Statistical modeling - probability distributions	10 Hrs
6	Unit VI EDA and Data Visualization Exploratory Data Analysis, Steps in EDA, Basic tools (plots, graphs and summary statistics) of EDA, Types of exploratory data analysis, Basic principles of data visualization, Benefits of Data Visualization, Data visualization techniques, Tools for data visualization	10 Hrs

Reference Books:

- 1) Data Mining : Introductory and Advanced Topics by Margaret Dunham, S. Sridhar, Pearson Publication
- 2) Data Mining concepts and Techniques by Jiawei Han and Micheline Kamber, ELSEVIER, Third Edition,

- 3) R and Data Mining, By Yanchang Zhao, Elsevier Inc., ISBN-10: 0123969638
- 4) Data Science from Scratch: First Principles with Python By O'Reilly Media, 20153.
- 5) Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining by Glenn J. Myatt John Wiley Publishers, 2007

Statistics_For_Data_Science.Pdf

- 6) <https://www.programmer-books.com/introducing-data-science-pdf/>
- 7) <https://www.cs.uky.edu/~keen/115/Haltermanpythonbook.pdf>
[http://math.ecnu.edu.cn/~lfzhou/seminar/\[Joel_Grus\]_Data_Science_from_Scratch_First_Princ.pdf](http://math.ecnu.edu.cn/~lfzhou/seminar/[Joel_Grus]_Data_Science_from_Scratch_First_Princ.pdf)
- 8) <https://www.pdfdrive.com/doing-data-science-d58735039.html>

WebSites:

- 9) <https://www.datacamp.com/community/open-courses/statistical-inference-and-data-analysis>
- 10) <https://www.coursera.org/learn/python-plotting?specialization=data-science-python>
<https://epgp.inflibnet.ac.in/>

Online Courses:

- 11) Data Mining : https://onlinecourses.swayam2.ac.in/cec19_cs01/preview
- 12) https://onlinecourses.nptel.ac.in/noc20_cs12/preview
- 13) <https://www.classcentral.com/course/swayam-data-mining-13982>
- 14) Data Science For Engineers : <https://onlinecourses.nptel.ac.in/noc19cs60>
- 15) Introduction to Data Science in Python :<https://www.coursera.org/learn/python-data-analysis>
- 16) Python for Data Science: <https://onlinecourses.nptel.ac.in/noc21cs33>

T.Y.B.C.A (Science)**SEMESTER V****Course Code: 24-BCA-353****Course Name: Operating Systems****Total Credits: 4****Course Objectives:**

- To study algorithms for CPU-scheduling, Process Creation and Termination.
- To understand the notion of a Multithreading and Inter-Process Communication.
- To learn Critical-Section problems and Classical Process-Synchronization problems.
- To know the Deadlock Concept, different methods for Preventing or Avoiding Deadlocks and techniques for Memory Management.
- To learn and understand File System, Directory Structure, File Allocation Methods and Disk Scheduling Algorithms.

Course Outcome:-

On completion of the course, student will be able to–

- Describe algorithms for Process, Memory and Disk Scheduling
- Apply technique for Inter-Process Communication and Multithreading.
- Implement concept of Critical-Section
- Compare and contrast Deadlock Avoidance and Prevention.
- Use functions for File System Management

Unit	Topic	No of lectures
1	Unit I Process Scheduling and Multithreaded Programming Process Scheduling – Scheduling queues, Schedulers, Context switch, Operations on Process – Process creation with program using fork(), Process termination, Inter-process Communication – Shared memory system, Message passing systems, Multithreaded Programming – Overview, Multithreading Models, Basic Concept – CPU-I/O burst cycle, CPU Scheduler, Pre-emptive Scheduling, Dispatcher, Scheduling Criteria, Scheduling Algorithms – FCFS, SJF, Priority scheduling, Round- robin scheduling, Multiple queue scheduling, Multilevel feedback queue scheduling, Thread Scheduling- Threads, benefits, Multithreading Models, Thread Libraries	14 Hrs
2	Unit II Process Synchronization Background, Critical Section Problem, Semaphores: Usage, Implementation,	08 Hrs

	Classic Problems of Synchronization – The bounded buffer problem, the reader, writer problem, the dining philosopher problem.	
3	Unit III Deadlock System Model, Deadlock Characterization – Necessary Conditions, Resource Allocation Graph Deadlock Prevention, Deadlock Avoidance - Safe state, Resource-Allocation-Graph Algorithm, Banker's, Algorithm, Deadlock Detection, Recovery from Deadlock – Process Termination, Resource Pre-emption	10 Hrs
4	Unit IV Memory Management Background – Basic Hardware, Address Binding, Logical Versus Physical, Address Space, Dynamic Loading, Dynamic Linking and Shared Libraries, Overlays, Swapping, Contiguous Memory Allocation – Memory mapping and protection, Memory allocation, Fragmentation Paging – Basic Method, Hardware support, Protection, Shared Pages, Segmentation – Basic concept, Hardware, Virtual Memory Management – Demand paging, Performance of demand paging, Page replacement – FIFO, Optimal, LRU, Second Chance Algorithm, Thrashing – Cause of thrashing, Working-Set Model	12 Hrs
5	Unit V File System File Concept, File Attribute, File Operations, File Types, File Structure, Access Methods - Sequential Access Method, Direct Access Method, Other Access, Methods, Directory overview, Single level directory, Two level directory, Tree structure directory, Acyclic graph directory, General graph directory, File System Structure and Implementation - Partitions and Mounting, Virtual, File Systems, Allocation Methods - Contiguous allocation, Linked allocation, Indexed allocation, Free Space Management – Bit vector, Linked list, Grouping, Counting, Space maps	10 Hrs
6	Unit VI Disk Scheduling System Model, Deadlock Characterization – Necessary Conditions, Resource Allocation Graph Overview, Disk Structure, Disk Scheduling, FCFS Scheduling, SSTF Scheduling, SCAN Scheduling, C-SCAN, Scheduling, LOOK Scheduling, Disk Management	06 Hrs

Reference Books:

- 1) Operating System Concepts, Avi Silberschatz, Peter Galvin, Greg Gagne, 8th Edition, Wiley Asia
- 2) Operating Systems: Internals and Design Principles, William Stallings, Prentice Hall of India
- 3) Modern Operating Systems 4th Edition, by Andrew Tanenbaum, Herbert Bos
- 4) Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI
- 5) Advanced Concepts in Operating Systems, Mukesh Singhal and Niranjana G Shivaratri, Tata McGraw Hill Inc, 2001

T.Y.B.C.A (Science)

SEMESTER V

Course Code: 24-BCA-354

Course Name: Artificial Intelligence

Total Credits: 2

Course Objectives:

- To learn various types of algorithms useful in Artificial Intelligence (AI).
- To convey the ideas in AI research related to emerging technology.
- To introduce ideas and techniques underlying the design of intelligent computer systems

Course Outcome:-

On completion of the course, student will be able to–

- Apply the suitable algorithms to solve AI problems.
- Identify and apply suitable intelligent agents for various AI applications
- Build smart system using different informed search / uninformed search or heuristic approaches
- Represent complex problems with expressive language of representation

Unit	Topic	No of lectures
1	Unit I Introduction to Artificial Intelligence Introduction to AI, Comparison of AI, Machine Learning, Deep Learning, Applications of AI, AI Techniques, Intelligent Agents, Agents and Environments, Structure of Agents	04 Hrs
2	Unit II Problems, Problem Spaces and search Defining problem as a State Space Search, Production System, Problem Characteristics, Search & Control Strategies, Problems – Water Jug problem, Missionary Cannibal Problem, Block words Problem, Monkey & Banana problem	06 Hrs
3	Unit III Searching Algorithms Uninformed Search Algorithms/Blind Search Techniques, Breadth-first Search, Depth-first Search, Informed (Heuristic) search Techniques, Generate-and-test, Simple Hill Climbing, Best First Search, Constraint Satisfaction, Means End Analysis, A* and AO*	06 Hrs
4	Unit IV Knowledge Representation Definition of Knowledge, Types of knowledge (Procedural and Declarative knowledge), Approaches to Knowledge Representation, Knowledge representation using Propositional and Predicate logic, Conversion to clause form, Resolution in Propositional and Predicate logic	06 Hrs

5	Unit V Recent Trends in AI and Applications Introduction to Machine Learning, Types of Learning, (Supervised, Unsupervised and Reinforcement Learning), Predictive Analytics (Weather Forecasting), AI-Powered Catbots (SBI card chatbot (ILA))	04 Hrs
6	Unit VI Advanced Topics and Ethical Considerations Natural Language Processing (NLP), Computer vision and image recognition, Bias and fairness in AI, AI in society and future directions	04 Hrs

Reference Books:

- 1) Artificial Intelligence, Tata McGraw Hill, Elaine Rich and Kevin Knight
- 2) Computational Intelligence, Eberhart, Elsevier, ISBN 9788131217832
- 3) Artificial Intelligence: A New Synthesis, Nilsson, Elsevier, ISBN 9788181471901
- 4) Introduction to Artificial Intelligence and Expert System, Dan Patterson, Prentice Hall of India Pvt. Ltd., New Delhi, 1997
- 5) Artificial Intelligence: A Modern Approach, Russel & Norvig, Pearson Education
- 6) Introduction to Machine Learning, Ethem Alpaydin, PHI

E-References:

- 1) <https://www.oracle.com/in/chatbots/what-is-a-chatbot/>
- 2) <https://www.dataversity.net/case-study-predictive-analytics-and-data-science-keep-an-eye-on-the-weather/>
- 3) <https://www.senseforth.ai/conversational-ai-case-studies/SBI-Cards/> 4) [https://www.oracle.com/in/artificial-intelligence/what-is-natural-language-processing/#:~:text=Natural%20language%20processing%20\(NLP\)%20is,natural%20language%20text%20or%20voice.](https://www.oracle.com/in/artificial-intelligence/what-is-natural-language-processing/#:~:text=Natural%20language%20processing%20(NLP)%20is,natural%20language%20text%20or%20voice.)
- 5) <https://www.simplilearn.com/computer-vision-article>
<https://towardsdatascience.com/understanding-bias-and-fairness-in-ai-systems-6f7fbfe267f3>

T.Y.B.C.A (Science)**SEMESTER V****Course Code: 24-BCA-355****Course Name: Computer Network****Total Credits: 2****Course Objectives:**

- To understand the fundamental concepts of networking standards, protocols and technologies.
- To study different techniques for framing, error control, flow control and routing.
- To learn role of protocols at various layers in the protocol stacks.
- To develop an understanding of modern network architectures from a design and performance perspective

Course Outcome:-

On completion of the course, student will be able to–

- Apply the suitable algorithms to solve AI problems.
- Identify and apply suitable intelligent agents for various AI applications
- Build smart system using different informed search / uninformed search or heuristic approaches
- Represent complex problems with expressive language of representation

Unit	Topic	No of lectures
1	Unit I Introduction Computer Networks Computer Networks applications –Business Application, Home Application, Broadcast and point- to-point networks, Network Topologies - Bus, Star, Ring ,Network Types- LAN, MAN, WAN, PAN, Wireless Networks, Home Networks, internetworks Protocols and standards – Definition of a Protocol, Protocol standards: De facto and De jure	04 Hrs
2	Unit II Network Models Concept of Network models, OSI Reference Model : Basic TCP/IP Model – layers and Protocol Suite, Addressing-Physical, Logical, Port addresses, Specific addresses	04 Hrs
3	Unit III Physical Layer Analog and Digital data, Analog and Digital signals, Digital Signals-Bit rate, Bit length Baseband and Broadband Transmission, Transmission	06 Hrs

	<p>Impairments– Attenuation,Distortion and Noise, Data Rate Limits– Noiseless channel: Nyquist’s bit rate, Shannon’s law , Performance of the Network , Line Coding :Concept, Characteristics, Techniques. Transmission Modes:Parallel and Serial, Multiplexing: FDM and TDM, Switching-Circuit Switching, Message Switching and Packet Switching.</p>	
4	<p>Unit IV Data Link Layer</p> <p>Functions, Framing – Concept, Types: fixed size, variable size, Framing Methods, Error detection: concept and techniques, Elementary data link protocols (simplex, Stop-And- Wait, Stop and wait ARQ, Go-Back-N ARQ Selective Repeat ARQ), Sliding Window Protocols working Principal, ALOHA protocols: working principal, types– pure and slotted, CSMA Protocol: CSMA/CD, CSMA/CA ,Controlled Access - Reservation, Polling and Token Passing, Channelization – Definitions – FDMA, TDMA and CDMA</p>	06 Hrs
5	<p>Unit V Network Layer</p> <p>IPv4 addresses: Address space, Notation, Classful addressing, Classless addressing, Sub netting, Super netting, IPv4: Datagram, Fragmentation, checksum, options, IPv6 addresses: Structure, address space, IPv6: packet format, Extension headers</p>	04 Hrs
6	<p>Unit VI Transport and Application Layer</p> <p>Process-to-Process Delivery, Multiplexing and De-multiplexing, User Datagram Protocol (UDP) - Datagram Format, Checksum, UDP operations, Use of UDP, Transmission Control Protocol (TCP)- TCP Services, TCP Features, TCP Segment, Structure, TCP Vs UDP, Domain Name System (DNS)</p> <p>- Distribution of Name Space, DNS in the Internet , E-MAIL - Architecture, User Agent, Message Transfer Agent - SMTP, Web Based Mail , WWW – Architecture , HTTP - HTTP Transaction</p>	06 Hrs

Reference Books:

- 1) Data Communications and Networking by Behrouz Forouzan, Fifth Edition, ISBN 978-0-07-337622-6 McGraw Hill.
- 2) Computer Networks, ANDREW S. Tanenbaum, Fifth Edition, ISBN-13: 978-0-13212695-3, Pearson

E-Books:

- 1) *Computer Networks – Andrew S.Tenenbaum*

https://books.google.co.in/books?id=b2HyGSu46lQC&printsec=frontcover&dq=Computer+Networks+ebook&hl=en&sa=X&ved=0ahUKEwj9woKyKLPahWIH7cAHR6_BKAQ6AEILjAB#v=one_page&q=Computer%20Networks%20ebook&f=false

E-references:

- 1) <https://www.tutorialspoint.com/sliding-window-protocol>
- 2) <https://www.geeksforgeeks.org/services-and-segment-structure-in-tcp/>

T.Y.B.C.A (Science)

SEMESTER V

Course Code: 24-BCA-356

Course Name: Advanced Java Laboratory

Total Credits: 2

Course Objectives:

- To understand collection classes and interfaces.
- To know the process of application development using Graphical User Interface (GUI).
- To acquire knowledge about handling databases using Java.
- To study web components for developing web applications.

Course Outcome:-

On completion of the course, student will be able to–

- Design end to end applications using object oriented constructs.
- Apply collection classes for storing java objects.
- Use Java APIs for program development.
- Handle abnormal termination of a program using exception handling.

Sr. No	Assignment	
1	Collection	4
2	Multithreading	4
3	Database Programming	4
4	Servlet and JSP	4
5	Applet	4

T.Y.B.C.A (Science)

SEMESTER V

Course Code: 24-BCA-357

Course Name: Data Mining and Data Science Laboratory

Total

Course Objectives:

- To understand the basics of R programming
- To study facilities for performing data mining with R packages
- To learn python functionalities and features used for data mining
- To explore Data analysis and Data Visualization using Python

Course Outcome:-

On completion of the course, student will be able to–

- Implement data mining tasks using R.
- Use the python packages to carry out data mining tasks.
Perform data analysis and data visualization using python packages

Sr.No	Assignment	
1	R Programming	4
2	Data Preprocessing	4
3	Classification	4
4	Association Rules	4
5	Regression Analysis and Outlier detection	4
6	Clustering	4

T.Y.B.C.A (Science)

SEMESTER V

Course Code: 24-BCA-358

Course Name: Operating Systems & AI Laboratory

Total

Course Objectives:

- To study algorithms for CPU-scheduling, Process Creation and Termination.
- To study the process management and scheduling.
- To Study Memory Management.
- To study and understand searching techniques

Course Outcome:-

On completion of the course, student will be able to–

- Describe algorithms for Process, Memory and Disk Scheduling Implement algorithms for Process scheduling and Memory management.
- Describe process synchronization and multithreading
- Compare and contrast the algorithms for memory management and its allocation policies.
- Use searching algorithms, Design a simple Expert system
- Understand the informed and uninformed problem types and apply search strategies to solve them.

Sr. No	Assignment	
1	Operations on processes	4
2	CPU Scheduling	4
3	Deadlock detection and avoidance	4
4	Page Replacement Algorithms	4
5	Implement A* Algorithm	4
6	Implement AO* Algorithmss	4

T.Y.B.C.A (Science)

SEMESTER VI

Course Code: 24-BCA-361

Course Name: Android Programming

Total Credits: 4

Course Objectives:

- To understand the Android Operating System
- To study Android Apps Development Cycle
- To learn to create Android Applications.

Course Outcome:-

On completion of the course, student will be able to–

- Describe the process of developing mobile applications.
- Create mobile applications on the Android Platform.
- Design and implement mobile applications involving data storage in SQLite database.
- Use location-based services while developing applications

Unit	Topic	No of lectures
1	Unit I Introduction to Android Overview, History and Features of Android Architecture of Android: Overview of Stack, Linux Kernel, Native Libraries, Android Runtime, Application Framework, Applications SDK Overview: Platforms, Tools – (JDK, SDK, Eclipse/Android Studio, ADT, AVD, Android Emulator), Versions, Creating your first Android Application	06 Hrs
2	Unit II Activities, Fragments and Intents Introduction to Activities, Activity Lifecycle, Introduction to Intents, Linking Activities using Intents, Calling built-in applications using Intents, Introduction to Fragments, Adding Fragments Dynamically, Lifecycle of Fragment, Toast	10 Hrs
3	Unit III Android User Interface Understanding the components of a screen: Views and View Groups, Linear Layout, Absolute Layout, Table Layout, Relative Layout, Frame Layout, Scroll Layout, Scroll View, Constraint Layout, Adapting to Display Orientation: Anchoring Views, Resizing and Repositioning Split Screen / Multi-Screen Activities	06 Hrs

4	<p>Unit IV Designing Your User Interface with Views</p> <p>Using Basic Views: TextView, Button, ImageButton, EditText, CheckBox, Switch, ToggleButton, RadioButton, and RadioGroup Views, ProgressBar View, AutoCompleteTextView View Using Picker Views: TimePicker View and DatePicker View Using List Views to Display Long Lists: ListView View, Using the Spinner View Understanding Specialized Fragments : Using a ListFragment, Using a DialogFragment Displaying Pictures and Menus: Using Image Views to Display Pictures, Gallery and ImageView views, Image Switcher, Grid View, Using Menus with Views, Creating the helper methods, Options Menu, Context Menu, VideoView: Play video from URL with using VideoView, VideoView Create, Optimized VideoView, Optimized VideoView in ListView</p>	13 Hrs
5	<p>Unit V Databases – SQLite, Messaging and E-mail</p> <p>Introduction to SQLite, SQLite Open Helper and SQLite Database Creating, opening and closing database, working with cursors, Insert, Update, Delete Building and executing queries, SMS Messaging: Sending SMS Messages Programmatically, Getting Feedback after Sending a Message, Sending SMS Messages Using Intent, Receiving SMS Messages, Caveats and Warnings, Sending E-mail</p>	14 Hrs
6	<p>Unit VI Location-Based Services and Google Map</p> <p>Display Google Maps: Creating the project, obtaining the Maps API Key, Displaying the Map, Displaying the Zoom Control, Changing Views, Navigating to a specific location Adding Markers, Getting the location that was touched, Geocoding and Reverse Geocoding Getting Location Data, Monitoring a Location</p>	11 Hrs

Reference Books:

- 1) Beginning Android4 Application Development, By Wei-Meng Lee WILEY India Edition WROX Publication
- 2) Professional Android 4 Application Development, By Reto Meier WROX Publication
- 3) Head First Android Development: A Brain-Friendly Guide, By David Griffiths and Dawn Griffiths

Websites:

- 1) The official site for Android developers - <https://developer.android.com>
- 2) <https://www.tutorialspoint.com/android/index.htm>
- 3) <https://www.javatpoint.com/android-tutorial>

T.Y.B.C.A (Science)

SEMESTER VI

Course Code: 24-BCA-362

Course Name: Programming in GO

Total Credits: 4

Course Objectives:

- To study various programming constructs in GO
- To understand salient features in GO
- To know advance features in GO

Course Outcome:-

On completion of the course, student will be able to–

- Describe the core features and concepts in Go
- Write simple Go programs using functions
- Apply defining methods and Go Interfaces
- Use Go routines and Channels. Explore Go Packages

Unit	Topic	No of lectures
1	Unit I Introduction Go Runtime and Compilations, Keywords and Identifiers, Constants and Variables, Operators and Expressions, Local Assignments, Booleans, Numeric, Characters, Pointers and Addresses, Strings, if-else, switch, for loop, Iterations, Using break and continue	10 Hrs
2	Unit II Functions Parameters and Return Values, Call by Value and Reference, Named Return Variables, Blank Identifiers, Variable Argument Parameters, Using defer statements, Recursive Functions, Functions as Parameters	10 Hrs
3	Unit III Working with Data Array Literals, Multidimensional Arrays, Array Parameters, Slices and Slice Parameters, Multidimensional Slices, Structures and Structure Parameters	08 Hrs
4	Unit IV Methods and Interfaces Method Declarations, Functions vs. Methods, Pointer and Value Receivers, Method Values and Expressions, Interface Types and Values, Type Assertions and Type Switches, Method Sets with Interfaces, Embedded Interfaces, Empty	12 Hrs

	Interfaces	
5	Unit V Goroutine and Channels Concurrency vs. Parallelism, Goroutine Functions and Lambdas, Wait Groups, Channels, Sending and Receiving, Unbuffered and Buffered Channels, Directional Channels, Multiplexing with select, Timers and Tickers	10 Hrs
6	Unit V Packages and Files Packages and Workspaces, Exporting Package Names, Import Paths and Named Imports, Package Initializations, Blank Imports, Unit Testing with Test Functions, Table Tests and Random Tests, Benchmarking, Working with Files	10 Hrs

Reference Books:

- 1) Introducing Go, Caleb Doxey, Oreilly publication
- 2) Learning Go Programming: Build Scalable Next-Gen Web Application using Golang (English Edition), Shubhangi Agarwal, BPB publication

E-Books:

- 1) Introducing Go By Caleb Doxey, Released January 2016 Publisher(s): O'Reilly Media, Inc. ISBN: 9781491941959 <https://www.oreilly.com/library/view/introducing-go/9781491941997/>
- 2) Go Bootcamp by Matt Aimonetti <http://www.golangbootcamp.com/book>

T.Y.B.C.A (Science)**SEMESTER VI****Course Code: 24-BCA-363****Course Name: Internet of Things (IoT)****Total Credits: 4****Course Objectives:**

- To understand fundamentals of Internet of Things (IoT) and Embedded Systems
- To know methodologies for IoT application development
- To study the IoT protocols, cloud platforms and security issues in IoT
- To learn real world application scenarios of IoT along with its societal and economic impact

Course Outcome:-

On completion of the course, student will be able to–

- Define Embedded Systems and the Internet of Things
- Apply enabling technologies for developing IoT systems
- Design simple IoT applications
- Analyse protocols for communication among IoT devices
- Describe cloud-based IoT systems
- Comprehend security issues in IoT applications

Unit	Topic	No of lectures
1	Unit I Introduction to Embedded System Definition, Characteristics of Embedded System, Real time systems, Real time tasks, Processor basics: General Processors in Computer Vs Embedded Processors, Micro controllers and Properties, Components of Microcontrollers, System-On- Chip and its examples, Components of Embedded Systems, Introduction to embedded processor.	10 Hrs
2	Unit II Internet of Things: Concepts Definition, Characteristics of IoT, Trends in Adoption of IoT, IoT Devices, IoT Devices Vs Computers, Basic Building Blocks. Physical Design of IoT: Things in IoT, Interoperability of IoT Devices, Sensors and Actuators, Need of Analog /Digital Conversion. Logical Design of IoT IoT functional blocks, IoT Enabling technologies, IoT levels and deployment templates, IoT applications	10 Hrs

3	Unit III Introduction to IoT Design Methodology Design Steps, Basics of IoT Networking, Networking Components, Internet Structure, IoT Communication Models and IoT Communication APIs, Sensor Networks, Four pillars of IoT: M2M, SCADA, WSN, RFID	10 Hrs
4	Unit IV Methods and Interfaces Protocol Standardization for IoT, M2M and WSN Protocols, RFID Protocol, Modbus Protocol, Zigbee Architecture. IP based Protocols: MQTT (Secure), 6LoWPAN, LoRa.	10 Hrs
5	Unit V Packages and Files Introduction to Cloud Storage Models, Communication API, Cloud for IoT, Introduction to Amazon Web Services for IoT and SkyNet IoT, Messaging Platform, Introduction to RESTful Web Services -GRPC, SOAP. Security model for IoT, Challenges in designing IOT applications	10 Hrs
6	Unit VI Case Study Fundamental of IoT software and components. To interface LED/Buzzer with Arduino/Raspberry Pi	10 Hrs

Reference Books:

- 1) Arshdeep Bahga, Vijay Madiseti, "Internet of Things– A hands- on approach", Universities Press, ISBN: 0: 0996025510, 13:978-996025515
- 2) Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", 2nd Edition, Wiley Publication, ISBN:978-1-119-99435-0
- 3) Dawoud Shenouda, Peter Dawoud, "Microcontroller and Smart Home Networks", ISBN: 9788770221566, e-ISBN: 9788770221559
- 4) Charles Crowell, "Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT", ISBN-13 : 979-8613100194
- 5) David Hanes, Gonzalo Salgueiro, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco Press, ISBN-13: 978-1- 58714-456-1 ISBN-10: 1-58714-456-5

T.Y.B.C.A (Science)

SEMESTER VI

Course Code: 24-BCA-364

Course Name: Blockchain Technology

Total Credits: 2

Course Objectives:

- To understand the Basics of Blockchain
- To learn different Protocols and Consensus Algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To incorporate the Models of Blockchain Ethereum

Course Outcome:-

On completion of the course, student will be able to–

- Define and Explain the Fundamentals of Blockchain
- Illustrate the Technologies of Blockchain
- Describe the Models of Blockchain
- Apply Hyperledger Fabric and Ethereum platform to implement the Blockchain Application.

Unit	Topic	No of lectures
1	Unit I Introduction to Blockchain Foundational Computing Concepts (Client-Server vs P2P Systems), Evolution of Blockchain, Blockchain vs Database, Blockchain Generations, Types of Blockchain, Benefits & Challenges of Blockchain Usage, Types of Networks, Layered Architecture of Blockchain System, Components of Blockchain or Distributed Ledger Technology (DLT), Cryptography (Private and Public keys, Hashing & Digital Signature), Blockchain Use Cases	08 Hrs
2	Unit II Working with Blockchain Cryptocurrency, Digital Currency Bitcoin & Ethereum, Understanding SHA256 Hash, Immutable Ledger, Distributed P2P Network, Mining Work (The NONCE and Cryptographic Puzzle), Byzantine Fault Tolerance, Proof of Byzantine Fault Tolerance, Consensus Protocols: Proof of Work, Proof of Stake, Proof of Elapsed Time, Defense Against Attackers, Competing Chains, Blockchain Demo https://andersbrownworth.com/blockchain	08 Hrs

3	Unit III Smart Contracts Ethereum Network, What is a Smart Contract?, Ethereum Virtual Machine (EVM), Ether, Gas, Solidity, Decentralized Applications (DApps) – NFT, Decentralized Autonomous Organizations (DAO), Hard and Soft Forks, Initial Coin Offerings (ICO), Demo of Smart Contracts	06 Hrs
4	Unit IV Hyperledger Fabric & Blockchain Applications Architecture of Hyperledger Fabric v1.1, Hyperledger Fabric Network Setup, Fabric Java SDK, Gateway SDK - Interfaces & Classes, Fabric CA, Security, Chain code Lifecycle – Development, Package, Installation, Approval, Commit, Blockchain in Healthcare, Blockchain in Financial and Banking Industry, Blockchain in Supply Chain Management, Blockchain Limitations as a Technology and Myths vs Reality of Blockchain Technology	08 Hrs

Reference Books:

- 1) S.Shukla, M.Dhawan, S.Sharma, S.Venkatesan “Blockchain Technology: Cryptocurrency and Applications”, Oxford University Press 2019.
- 2) Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and Cryptocurrency technologies: A Comprehensive Introduction”, Princeton University Press, 2016.
- 3) Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies.
- 4) DR. Gavin Wood, “ETHEREUM: A Secure Decentralized Transaction Ledger,” Yellow paper.2014.
- 5) Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts.

T.Y.B.C.A (Science)

SEMESTER VI

Course Code: 24-BCA-365

Course Name: Cloud Computing

Total Credits: 2

Course Objectives:

- To study cloud computing concepts, technologies, architecture and applications.
- To understand issues in application deployment and implementations in cloud environment.
- To learn recent trends in cloud computing.

Course Outcome:-

On completion of the course, student will be able to–

- Explain the core issues in cloud computing such as security, privacy, and interoperability.
- Choose the appropriate technologies, algorithms, and approaches for the given application.
- Compare and contrast various cloud services

Unit	Topic	No of lectures
1	Unit I Introduction to Cloud Computing Overview, Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service	03 Hrs
2	Unit II Abstraction and Virtualization Using Virtualization Technology, Load Balancing and Virtualization – The Google Cloud, Understating Hypervisors – Virtual Machine types, Exploring SaaS – salesforce.com, Exploring PaaS- force.com, Exploring IaaS – Amazon EC2	06 Hrs
3	Unit III Programming Environment Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS, Microsoft Azure, Emerging Cloud Software Environments.	06 Hrs
4	Unit IV Deploying Applications and cloud services Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications	05 Hrs

5	Unit IV Emerging trends in cloud computing Multi-Cloud Vs Omni-Cloud, Integrated Blockchain technology, Kubernetes, Cloud AI, Intelligent SaaS, Kubernetes Supremacy, Containerization by Industry Giants	05 Hrs
6	Unit IV Security In The Cloud Security Overview, Cloud Security Challenges and Risks, Software-as-a-Service Security, Security Governance, Risk Management – Security Monitoring, Security Architecture Design	05 Hrs

Reference Books:

- 1) Cloud Computing: Principles and Paradigms, Editors, RajkumarBuyya, James Broberg, Andrzej M. Goscinski, Wiley,2011.
- 2) Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010.
- 3) Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010.
- 4) Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley- India,2010.
- 5) Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, Brian J. S. Chee and Curtis Franklin.
- 5) AWS, The ultimate guide from beginners to advanced, Maveric Koston.
- 6) Microsoft Azure: Planning, Deploying, and Managing Your Data Center in the Cloud, Anthony Puca, Mike Manning, Marshal Copeland, Julian Soh, David Gollob.

T.Y.B.C.A (Science)

SEMESTER VI

Course Code: 24-BCA-366**Course Name: Android Programming Laboratory****Total Credits: 2****Course Objectives:**

- To understand the Android Operating System
- To study Android Apps Development Cycle
- To learn to create Android Applications

Course Outcome:-

On completion of the course, student will be able to–

- Describe the process of developing mobile applications.
- Create mobile applications on the Android Platform.
- Design and implement mobile applications involving data storage in SQLite database.
- Use location-based services while developing applications

Sr.No	Assignment	
1	Introduction to Android	4
2	Activities, Fragments and Intents	4
3	Android User Interface	4
4	Designing User Interface with Views	4
5	Databases-SQLite, Messaging and E-mail	4
6	Location-Based Services and Google Map	4

T.Y.B.C.A (Science)

SEMESTER VI

Course Code: 24-BCA-367

Course Name: Programming in GO and IoT Laboratory

Total Credits: 2

Course Objectives:

- To understand the Android Operating System
- To introduce essential programming features in GO
- To become familiar with programming techniques in GO
- To understand the technique of building Packages and File handling
- To learn developing simple IoT applications

Course Outcome:-

On completion of the course, student will be able to–

- Write programs using features supported in GO
- Handle errors and utilize Goroutines and Channels
- Write programs on File handling
- Compare and contrast features of GO with other object oriented languages
- Design Simple IoT application

Programming in GO Laboratory		
Sr. No.	Assignment	
1	Introduction to Go Programming	4
2	Functions	4
3	Working with data	4
4	Methods and Interfaces	4
5	Go routines and channels	4
6	Packages and files	4

Internet of Things (IoT) Laboratory		
Sr. No.	Assignment	
1	To Study Raspberry Pi / Arduino Architecture and Basic Programming	4
2	Interfacing of LED/Buzzer/Push button with Arduino/Raspberry Pi. and write a program to turn ON LED when push button is pressed or at sensor detection and write a program to turn ON LED when push button is pressed or at sensor detection	4
3	Interfacing Raspberry-Pi/ Adriano with IR sensor/Camera sensor	4
4	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity reading	4
5	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth	4
6	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud	4

T.Y.B.C.A (Science)**SEMESTER VI****Course Code: 24-BCA-368****Course Name: Project Laboratory****Total Credits: 2****Course Objectives:**

- To understand concepts of Project Management
- To know how various tools for development and management of software projects are used to carry out various tasks involved
- To learn the importance of project documentation

Course Outcome:-

On completion of the course, student will be able to–

- Demonstrate a sound technical knowledge of selected project topic.
- Apply techniques for project management
- Create various documents used during the development of the project and a project report

Project Implementation Guidelines:

Sr. No.	Guidelines
1	Students shall choose any topic for project work in consultation with project guide, Project In-charge and head of the department.
2	The students shall work on a Project in a group of not more than three students.
3	Students are expected to work on the chosen project during the entire semester.
4	Students shall undertake application oriented/web-based/database-oriented/research based work.
5	Students shall successfully implement the chosen work. Only a hypothetical / theoretical study shall not be accepted.
6	Students shall choose any appropriate programming language/ platform, computational techniques and tools in consultation with the guide, In-charge and the head of the department.
7	The faculty members from affiliated college shall act as a project guide for each project group with equal distribution of groups amongst each eligible faculty.
8	The guide shall track and monitor the project progress on a weekly basis by considering the workload of 4 laboratory hours per week.

9	The project work shall be evaluated based on the novelty of the topic, scope of the work, relevance to computer science, adoption of emerging techniques/technologies and its real-world application etc.
10	<p>Students shall prepare a project report with the following contents:</p> <p>a) Title Page Certificate Index Page</p> <p>b) Detailing description of the following with their sub sections:-</p> <ul style="list-style-type: none"> - Title: A suitable title giving the idea about what work is proposed. - Introduction: An introduction to the topic giving proper background of the topic. - Requirement Specification: Specify Software/hardware/data requirements. - System Design details :Methodology/Architecture/UML/DFD/Algorithms/protocols used(whichever is applicable) - System Implementation: Code implementation - Results: Test Cases/Tables/Figures/Graphs/Screen shots/Reports etc. - Conclusion and Future Scope: Specify the Final conclusion and future scope - References: Books, web links, research articles etc.
11	The Project report should be prepared in a spiral bound form with adequate number of copies. Copy shall be submitted to the guide and college for the records.
12	The Project work and report shall be certified by the concerned Project guide and Head of the department.
13	Students shall make a presentation of working project and will be evaluated as per the Project evaluation scheme as detailed below

Assignments using Gantt Project tools

- Students are advised to carry out the following assignments w.r.t. their chosen project topics

1	<p>Create Project Plan</p> <ul style="list-style-type: none"> • Specify project name and start and finish dates. • Identify and define project tasks. • Define duration for each project task. • Define milestones in the plan • Define dependency between tasks • Define project calendar. • Define project resources and specify resource type • Assign resources against each task and baseline the project plan
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2

Execute and Monitor Project Plan

- Update %Complete with current task status.
- Review the status of each task.
- Compare Planned vs Actual Status
- Review the status of Critical Path
- Review resources assignment status

3

Generate Dashboard and Reports

- Dashboard
 - Project Overview, Cost Overview, Upcoming Tasks
- Resource Reports
 - Over-allocated Resources, Resource Overview
- Cost Reports
 - Earned Value Report, Resource Cost Overview, Task-Cost Overview
- Progress Reports
 - Critical Tasks, Milestone Report, Slipping Tasks

Evaluation Scheme

I. Continuous Evaluation, Progress Report: 15 marks

II. End Semester Examination in the form of presentation/demonstration and viva:
35 marks

Description	Marks
Presentation & Project Report	15
Demonstration of the Project	15
Viva	05
Total	35

Note: Submission of Certified Project Report is mandatory for appearing the Practical Examination (Project).