

Business Intelligence and Data Analytics		Semester	7
Course Code	BCB701	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory/practical		
Course objectives:			
<ul style="list-style-type: none"> ● Understand the nature of data, statistical Modelling and visualization. ● Learn concepts of Business Intelligence and Data Warehousing. ● Gain knowledge on Data mining process and SNA, text & Web analytics. 			
Teaching-Learning Process (General Instructions)			
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.			
<ol style="list-style-type: none"> 1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods could be adopted to attain the outcomes. 2. Use of Video/Animation to explain the functioning of various concepts. 3. Encourage collaborative (Group Learning) Learning in the class. 4. Ask at least three HOT (Higher Order Thinking) questions in the class, which promotes critical thinking. 5. Adopt Problem Based-Learning (PBL), which fosters students' Analytical skills, and develops design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than recall it. 			
MODULE-1			
An Overview of Business Intelligence, Analytics, Data Science, and AI: Changing Business Environments and Evolving Needs for Decision Support and Analytics, Decision-Making Processes and Computerized Decision Support Framework, Evolution of Computerized Decision Support to Analytics/Data Science, A Framework for Business Intelligence, Analytics Overview.			
Artificial Intelligence - Concepts, Drivers, Major Technologies, and Business Applications: Artificial Intelligence: Concepts, Drivers, Major Technologies, and Business Applications, Conversational AI—Chatbots.			
[Note: Analytics in action – Excluded]			
Chapter 1 (1.2-1.6), Chapter 2(2.4-2.6, 2.9)			
MODULE-2			
Descriptive Analytics I -Nature of Data, Big Data, and Statistical Modeling: The Nature of Data in Analytics, A Simple Taxonomy of Data, The Art and Science of Data Preprocessing, Definition of Big Data, Fundamentals of Big Data Analytics, Big Data Technologies, Big Data and Stream Analytics, Statistical Modeling for Business Analytics, Regression Modeling for Inferential Statistics.			
[Note: Analytics in action – Excluded]			
Chapter 3 (3.2-3.10)			
MODULE-3			
Descriptive Analytics II: Business Intelligence Data Warehousing, and Visualization: Business Intelligence and Data Warehousing, Data Warehousing Process, Data Warehousing Architectures, Data Management and Warehouse Development, Data Warehouse Administration, Security Issues, and Future Trends, Business Reporting, Data Visualization, Different Types of Charts and Graphs, The Emergence of Visual Analytics, Information Dashboards.			
[Note: Analytics in action – Excluded]			

Chapter 4 (4.2-4.11)
MODULE-4
<p>Predictive Analytics I - Data mining process, methods, and Algorithms: Data Mining Concepts and Applications, Data Mining Applications, Data Mining Process, Data Mining Methods.</p> <p>Prescriptive Analytics - Optimization and Simulation: Model-Based Decision-Making, Structure of Mathematical Models for Decision Support, Certainty, Uncertainty, and Risk, Decision Modeling with Spreadsheets.</p> <p>[Note: Analytics in action – Excluded]</p> <p>Chapter 5 (5.2-5.5), Chapter-8 (8.2-8.5)</p>
MODULE-5
<p>Predictive Analytics II - Text, Web, and Social Media Analytics: Text Analytics and Text Mining Overview, Natural Language Processing (NLP), Text Mining Applications, Text Mining Process, Sentiment Analysis and Topic Modeling, Web Mining Overview, Search Engines, Web Usage Mining (Web Analytics), Social Analytics.</p> <p>[Note: Analytics in action – Excluded]</p> <p>Chapter 6 (6.2-6.10)</p>

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Improving student retention with data driven analysis [Use Excel with graph] – Refer analytics in action 3.1.
2	Executive dashboard design for a given business analytics scenario using Tableau Public.
3	Generate visual analytics for a given business tasks and data using Tableau Public.
4	Enhancing customer experience with predictive analytics and data mining by taking suitable business scenario (Use Weka/RapidMiner/Spark/R/Microsoft power BI).
5	Cluster analysis using k-means algorithm for a given customer data set (use Python/R/any other tool).
6	Identify frequent item sets using the Apriori algorithm for a given transaction data set (use Python/R/any other tool).
7	Use a dataset of customer product reviews (e.g., Amazon reviews) to classify the sentiment of each review as positive, negative, or neutral using a pre-trained machine learning model (e.g., Naïve Bayes). Evaluate the accuracy of your sentiment classifier. (use Python/R/any other tool).
8	Use text mining techniques to analyse a collection of news articles. Identify the most frequent terms and perform topic modelling using Latent Dirichlet Allocation (LDA) to find hidden topics within the articles. (use Python/R/any other tool).
9	Given a dataset representing a social network (e.g., Twitter follower data), create a graph and perform Social Network Analysis (SNA) to find the most influential users using centrality measures like degree, closeness, and betweenness centrality. (use Python/R/any other tool).
10	Using web scraping tools, extract the content from a set of web pages (e.g., news, blogs). Analyse the text to identify trends and topics. (use Python/R/any other tool).
11	Extract user comments from a web forum or blog post using web scraping. Perform sentiment analysis on the extracted data and identify the overall tone of the discussion. Visualize the sentiment distribution using a pie chart or bar graph. (use Python/R/any other tool).
12	Using web crawling techniques, analyse the internal and external link structure of a website. Create a graph of the website's hyperlink structure and identify key pages using PageRank or HITS algorithm. (use Python/R/any other tool).

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Explain the role of business intelligence and analytics in a dynamic business environment.
- Apply modern tools for Statistical Modelling and Visualization.
- Demonstrate descriptive analytics for Business Intelligence and Data Warehousing.
- Implement algorithms for data mining techniques and processes.
- Develop scripts for Text & Web mining and social network analysis.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks**).
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test (**duration 02/03 hours**) after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks**.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question

papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Textbook:

1. Ramesh Sharda, Dursun Delen and Efraim Turban, "Business Intelligence, Analytics, Data Science and AI – A Managerial Perspective", 5th edition, Global Edition, Pearson Education Limited, 2024.

Reference Books:

1. Steve Williams, Business Intelligence Strategy and Big Data Analytics - A General Management Perspective, Morgan Kaufmann (Elsevier), 2016.
2. Vincent Charles, Pratibha Garg, Neha Gupta and Mohini Agarwal, Data Analytics and Business Intelligence - Computational Frameworks, Practices, and Applications, CRC Press, 2023.
3. Ira J. Haimowitz, DATA ANALYTICS FOR BUSINESS - Lessons for Sales, Marketing, and Strategy, Routledge (Taylor & Francis), 2023.

Web links and Video Lectures (e-Resources):

- <https://www.tableau.com/business-intelligence/what-is-business-intelligence>
- https://onlinecourses.nptel.ac.in/noc24_cs65/preview
- https://onlinecourses.nptel.ac.in/noc21_cs45/preview
- <https://cloud.google.com/learn/what-is-business-intelligence>
- <https://www.geeksforgeeks.org/what-is-data-analytics/>

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

For a batch of TWO students, submission of analytics report and conduction of group discussion (one example/case per batch) on examples (refer section 1.7) and Analytics in Action (Cases) of Textbook **[10 Marks]**

PARALLEL COMPUTING		Semester	VII
Course Code	BCS702	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory/Practical		
<p>Course objectives: This course will enable to,</p> <ul style="list-style-type: none"> • Explore the need for parallel programming • Explain how to parallelize on MIMD systems • To demonstrate how to apply MPI library and parallelize the suitable programs • To demonstrate how to apply OpenMP pragma and directives to parallelize the suitable programs • To demonstrate how to design CUDA program 			
<p>Teaching-Learning Process (General Instructions) These are sample Strategies that teachers can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none"> 1. Lecturer method (L) need not to be only traditional lecture methods, but alternative effective teaching methods could be adopted to attain the outcomes. 2. Use of Video/Animation to explain functioning of various concepts. 3. Encourage collaborative (Group Learning) Learning in the class. 4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking. 5. Adopt Programming assignment, which fosters student's Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it. 			
MODULE-1			
<p>Introduction to parallel programming, Parallel hardware and parallel software – Classifications of parallel computers, SIMD systems, MIMD systems, Interconnection networks, Cache coherence, Shared-memory vs. distributed-memory, Coordinating the processes/threads, Shared-memory, Distributed-memory.</p>			
MODULE-2			
<p>GPU programming, Programming hybrid systems, MIMD systems, GPUs, Performance – Speedup and efficiency in MIMD systems, Amdahl's law, Scalability in MIMD systems, Taking timings of MIMD programs, GPU performance.</p>			
MODULE-3			
<p>Distributed memory programming with MPI – MPI functions, The trapezoidal rule in MPI, Dealing with I/O, Collective communication, MPI-derived datatypes, Performance evaluation of MPI programs, A parallel sorting algorithm.</p>			
MODULE-4			
<p>Shared-memory programming with OpenMP – openmp pragmas and directives, The trapezoidal rule, Scope of variables, The reduction clause, loop carried dependency, scheduling, producers and consumers, Caches, cache coherence and false sharing in openmp, tasking, tasking, thread safety.</p>			
MODULE-5			

GPU programming with CUDA - GPUs and GPGPU, GPU architectures, Heterogeneous computing, Threads, blocks, and grids Nvidia compute capabilities and device architectures, Vector addition, Returning results from CUDA kernels, CUDA trapezoidal rule I, CUDA trapezoidal rule II: improving performance, CUDA trapezoidal rule III: blocks with more than one warp.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Write a OpenMP program to sort an array on n elements using both sequential and parallel mergesort(using Section). Record the difference in execution time.
2	Write an OpenMP program that divides the Iterations into chunks containing 2 iterations, respectively (OMP_SCHEDULE=static,2). Its input should be the number of iterations, and its output should be which iterations of a parallelized for loop are executed by which thread. For example, if there are two threads and four iterations, the output might be the following: a. Thread 0 : Iterations 0 — 1 b. Thread 1 : Iterations 2 — 3
3	Write a OpenMP program to calculate n Fibonacci numbers using tasks.
4	Write a OpenMP program to find the prime numbers from 1 to n employing parallel for directive. Record both serial and parallel execution times.
5	Write a MPI Program to demonstration of MPI_Send and MPI_Recv.
6	Write a MPI program to demonstration of deadlock using point to point communication and avoidance of deadlock by altering the call sequence
7	Write a MPI Program to demonstration of Broadcast operation.
8	Write a MPI Program demonstration of MPI_Scatter and MPI_Gather
9	Write a MPI Program to demonstration of MPI_Reduce and MPI_Allreduce (MPI_MAX, MPI_MIN, MPI_SUM, MPI_PROD)

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Explain the need for parallel programming
- Demonstrate parallelism in MIMD system.
- Apply MPI library to parallelize the code to solve the given problem.
- Apply OpenMP pragma and directives to parallelize the code to solve the given problem
- Design a CUDA program for the given problem.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

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- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks**).
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test (**duration 02/03 hours**) after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks**.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Textbook:

1. Peter S Pacheco, Matthew Malensek – An Introduction to Parallel Programming, second

edition, Morgan Kauffman.

2. Michael J Quinn – Parallel Programming in C with MPI and OpenMp, McGrawHill.

Reference Books:

1. Calvin Lin, Lawrence Snyder – Principles of Parallel Programming, Pearson
2. Barbara Chapman – Using OpenMP: Portable Shared Memory Parallel Programming, Scientific and Engineering Computation
3. William Gropp, Ewing Lusk – Using MPI: Portable Parallel Programming, Third edition, Scientific and Engineering Computation

Web links and Video Lectures (e-Resources):

1. Introduction to parallel programming: <https://nptel.ac.in/courses/106102163>

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Programming Assignment at higher bloom level (10 Marks)

CRYPTOGRAPHY & NETWORK SECURITY		Semester	7
Course Code	BCS703	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	4:0:0:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	3
Examination type (SEE)	Theory		
<p>Course objectives:</p> <ol style="list-style-type: none"> 1. Understand the basics of Cryptography concepts, Security and its principle 2. To analyse different Cryptographic Algorithms 3. To illustrate public and private key cryptography 4. To understand the key distribution scenario and certification 5. To understand approaches and techniques to build protection mechanism in order to secure computer networks 			
<p>Teaching-Learning Process These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none"> 1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes. 2. Use of Video/Animation to explain functioning of various concepts. 3. Encourage collaborative (Group Learning) Learning in the class. 4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking. 5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it. 6. Introduce Topics in manifold representations. 7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them. 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding 9. Use any of these methods: Chalk and board, Active Learning, Case Studies 			
Module-1 10 hours			
<p>A model for Network Security, Classical encryption techniques: Symmetric cipher model, Substitution ciphers-Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, One time pad, Steganography. Block Ciphers and Data Encryption Standards: Traditional Block Cipher structures, data Encryption Standard (DES), A DES Example, The strength of DES, Block cipher design principles.</p> <p>Chapter 1: 1.8 Chapter 3: 3.1, 3.2, 3.5 Chapter 4: 4.1, 4.2, 4.3, 4.4, 4.5</p>			
Module-2 10 hours			

<p>Pseudorandom number Generators: Linear Congruential Generators, Blum Blum Shub Generator.</p> <p>Public key cryptography and RSA: Principles of public key cryptosystems-Public key cryptosystems, Applications for public key cryptosystems, Requirements for public key cryptography, Public key Cryptanalysis, The RSA algorithm: Description of the Algorithm, Computational aspects, The Security of RSA.</p> <p>Diffie-Hellman key exchange: The Algorithm, Key exchange Protocols, Man-in-the-middle Attack, Elliptic Curve Cryptography: Analog of Diffie-Hellman key Exchange, Elliptic Curve Encryption/Decryption, Security of Elliptic Curve Cryptography.</p> <p>Chapter 8: 8.2 Chapter 9: 9.1, 9.2 Chapter 10: 10.1, 10.4</p>
Module-3 10 hours
<p>Applications of Cryptographic Hash functions, Two simple Hash functions, Key management and distribution: Symmetric key distribution using symmetric encryption, Symmetric key distribution using asymmetric encryption, Distribution of public keys, X.509 Certificates, Public Key Infrastructures</p> <p>Chapter 11: 11.1, 11.2 Chapter 14: 14.1, 14.2, 14.3, 14.4, 14.5</p>
Module-4 10 hours
<p>User Authentication: Remote user authentication principles, Kerberos, Remote user authentication using asymmetric encryption.</p> <p>Web security consideration, Transport layer security.</p> <p>Email Threats and comprehensive email security, S/MIME, Pretty Good Privacy.</p> <p>Chapter 15: 15.1, 15.3, 15.4 Chapter 17: 17.1, 17.2 Chapter 19: 19.3, 19.4, 19.5</p>
Module-5 10 hours
<p>Domainkeys Identified Mail.</p> <p>IP Security: IP Security overview, IP Security Policy, Encapsulating Security Payload, Combining security associations, Internet key exchange.</p> <p>Chapter 19: 19.9 Chapter 20: 20.1, 20.2, 20.3, 20.4, 20.5</p>
<p>Course outcome</p> <p>At the end of the course, the student will be able to :</p> <p>CO1: Explain the basic concepts of Cryptography and Security aspects</p> <p>CO2: Apply different Cryptographic Algorithms for different applications</p> <p>CO3: Analyze different methods for authentication and access control.</p> <p>CO4: Describe key management, key distribution and Certificates.</p> <p>CO5: Explain about Electronic mail and IP Security.</p>

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Books

Text Books:

William Stallings, "Cryptography and Network Security", Pearson Publication, Seventh Edition.

References:

1. Keith M Martin, "Everyday Cryptography", Oxford University Press
2. V.K Pachghare, "Cryptography and Network Security", PHI, 2nd Edition

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Group assignment (TWO) to implement Cryptographic Algorithms (15 + 10 marks)