



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Information Technology

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Tech (CSE)

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS201 N	DCC	Advance Computer Architecture & Organization	Max	60	20	20	0	0	3	0	0	3
			Min	24	16		0	0				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Describe current and emerging trends in computer architectures, focusing on performance and the hardware/software interface.
2. Analyzing fundamental issues in architecture design and their impact on application performance.
3. Identify the performance and efficiency in advanced multiple-issue processors
4. Identify and Analyzing various memory models.
5. Describe various techniques to enhance a processors ability.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** Know the classes of computers, and new trends and developments in computer architecture.
- CO2** Understand pipelining, instruction set architectures, memory addressing.
- CO3** Understand symmetric shared-memory architectures and their performance.
- CO4** Understand multiprocessor cache coherence using the directory based and snooping class of protocols.
- CO5** Understand the various models to achieve memory consistency.

TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching

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SEMESTER-II (2026-28)

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			Marks	THEORY			PRACTICAL					
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MTCS201 N	DCC	Advance Computer Architecture & Organization	Max	60	20	20	0	0	3	0	0	3
			Min	24	16		0	0				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

T2 ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1 Quiz
- ATL2 Activity Based Learning
- ATL3 Midterm Exams
- ATL4 Flip Class
- ATL5 Seminar Presentation
- ATL6 Assignments
- ATL7 Poster
- ATL8 Oral Viva-voce examination
- ATL9 Industrial Visit Report

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Overview of Parallel Processing and Pipelining Processing, study and comparison of uni-processors and parallel processors, Evolution of parallel processors, Necessity of high performance, Architectural Classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism.	10	ATL1 ATL4 ATL6
II	Principles and implementation of Pipelining, Pipeline Architecture, Study and comparison of processors with and without pipelining, Linear pipeline processor, Nonlinear pipeline processor Instruction pipeline design, Mechanisms for instruction pipelining, pipeline hazards, Dynamic instruction scheduling -score boarding and	9	ATL2 ATL3 ATL8

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS201 N	DCC	Advance Computer Architecture & Organization	Max	60	20	20	0	0	3	0	0	3
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Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

	Tomosulo's algorithm, Branch handling techniques, Arithmetic Pipeline Design, Static arithmetic pipeline, Multifunctional arithmetic pipelines. Superscaler pipeline design, Super pipeline processor design.		
III	Study and comparison of Vector and array processors, Vector Processing Principles, Vector instruction types, Vector-access memory schemes. Vector supercomputer architecture, SIMD Computer Organization Masking and Data network mechanism, distributed memory model and shared memory model, Parallel Algorithms For Array Processors: Matrix Multiplication. Sorting, SIMD computer organization, Implementation issues of Matrix multiplication and sorting on array processor and their analysis.	8	ATL2 ATL3 ATL5
IV	Microprocessor Architectures, study and comparison of Loosely and Tightly coupled multiprocessors. Loosely and Tightly coupled multiprocessors, Processor characteristics of multiprocessors, Inter Processor communication network, Time shared bus, Crossbar switch, Multiport Memory Model, Memory contention and arbitration techniques, Cache coherence, Snoopy protocols, Directory based protocols. Message routing schemes in multicomputer network, deadlock and virtual channel.	7	ATL2 ATL5 ATL8
V	Study of Architecture of Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions, Parallel Programming Techniques: Message passing program development, Synchronous and asynchronous message passing, Message passing parallel programming, Shared Memory Programming, Data Parallel Programming. Implementation issues of a multithreaded program.	8	ATL5 ATL7 ATL9
Total Hours		30	

ADDITIONAL RESOURCES

A. Value addition to course content/ Skill enhancement content:

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS201 N	DCC	Advance Computer Architecture & Organization	Max	60	20	20	0	0	3	0	0	3
			Min	24	16		0	0				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

<https://nptel.ac.in/courses/106106166>

B. Remedial classes for slow learners:

As per the SVVV SOP for slow and fast learners.

SUGGESTED READINGS:

Textbooks

1. K. Hwang and F. A. Briggs, *Computer Architecture and Parallel Processing*. New York, NY, USA: McGraw-Hill International Editions, 1984.
2. J. P. Hayes, *Computer Architecture and Organization*, 3rd ed. New York, NY, USA: McGraw-Hill, 1998.

Reference Books

1. V. Rajaraman and C. S. R. Murthy, *Parallel Computers: Architecture and Programming*. New Delhi, India: PHI Learning, 2000.
2. R. Kain, *Advanced Computer Architecture: A Systems Design Approach*. New Delhi, India: PHI Learning, 2010.
3. M. J. Flynn, *Computer Architecture: Pipelined and Parallel Processor Design*. New Delhi, India: Narosa Publishing House, 1995.
4. K. Hwang and F. A. Briggs, *Computer Architecture and Parallel Processing*. New York, NY, USA: McGraw-Hill, 1984.
5. D. E. Culler and J. P. Singh, *Parallel Computer Architecture: A Hardware/Software Approach*. San Francisco, CA, USA: Morgan Kaufmann Publishers, 1999.

Suggested resources (Websites/e-books)

1. S. G. Shiva, *Advanced Computer Architecture*. Boca Raton, FL, USA: CRC Press (Taylor & Francis Group), 2000.

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS201 N	DCC	Advance Computer Architecture & Organization	Max	60	20	20	0	0	3	0	0	3
			Min	24	16		0	0				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Outcome s	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	3	-	-	-	1	1	-	3	2	1	1
CO2	3	3	2	2	3	2	-	3	2	2	1	3	3	1	3
CO3	3	3	3	3	3	2	1	2	3	2	2	3	3	2	3
CO4	1	2	3	2	2	3	3	2	3	3	2	1	2	3	1
CO5	3	2	1	2	3	1	2	3	2	2	3	3	2	3	1

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment *	END SEM University Exam	Teachers Assessment *				
MTCS202N	DCC	Advance Database Management System	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

- Describe database management system internals. Understand and describe internal algorithms in detail. Decide on optimization issues given a known database workload, by manipulating indexes, choosing more adequate data types, and modifying queries.
- Identify opportunities for the use of the object model, and design and code client code to manipulate an object database.
- Analyze and optimize transactional code, identifying causes of possible anomalies and correct them.
- Identify and be able to use recent and advanced database techniques (e.g. in concurrency control, buffer management, and recovery).
- Analyze, describe and use other models than the Relational. Analyze, compare and evaluate alternative database architectures and models in different application contexts. Identify limitations of the standard Relational databases in certain application domains, e.g. for multidimensional data, or unstructured data.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.
- CO2** Be familiar with the relational database theory, and be able to write relational algebra expressions for queries.
- CO3** Be familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B-tree, and hashing.
- CO4** Master the basics of query evaluation techniques and query optimization.
- CO5** Be familiar with the basic issues of transaction processing and concurrency control.

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			Ma rks	THEORY			PRACTICAL					
				END SEM Unive rsity Exam	Tw o Te rm Ex am	Te ac he rs As ses sm ent *	END SEM Unive rsity Exam	Te ac he rs As ses sm ent *				
MTCS202 N	DCC	Advance Database Management System	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
T2 ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1** Quiz
ATL2 Activity Based Learning
ATL3 Midterm Exams
ATL4 Flip Class
ATL5 Seminar Presentation
ATL6 Assignments
ATL7 Poster
ATL8 Oral Viva-voce examination
ATL9 Industrial Visit Report

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Introduction to Database Systems: Database System Concepts and Architecture, Data Models, Data Independence, SQL: DDL, DML, DCL, Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF. Query Processing and Optimization: Query Processing, Syntax Analyzer, Query Decomposition, Query Optimization, Heuristic Query Optimization, Cost Estimation, Cost Functions for Select, Join, Query	10	ATL1 ATL2 ATL6

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			Ma rks	THEORY			PRACTICAL					
				END SEM Unive rsity Exam	Tw o Te rm Ex am	Te ac he rs As ses sm ent *	END SEM Unive rsity Exam	Te ac he rs As ses sm ent *				
MTCS202 N	DCC	Advance Database Management System	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

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	Evaluation Plans.		
II	Object Oriented and Object Relational Databases: Object Oriented Concepts, Object Oriented Data Model, Object Definition Language, Object Query Language, Object Relational Systems, SQL3, ORDBMS Design.	9	ATL4 ATL5 ATL8
III	Transaction Processing and Concurrency Control: Transaction Processing Concepts, Concurrency Control Techniques: Two-phase Locking, Timestamp Ordering, Multiversion, Validation, Multiple Granularity Locking.	8	ATL2 ATL3 ATL8
IV	Backup and Recovery: Types of Database Failures, Types of Database Recovery, Recovery Techniques: Deferred Update, Immediate Update, Shadow Paging, Checkpoints, Buffer Management.	7	ATL2 ATL3 ATL6
V	Introduction to Data Warehousing and Data Mining: Introduction to OLAP, OLTP, Data Warehouse, Data Marts, Data Mining, Data Mining Process. Distributed Databases: Distributed Database Concepts, Advantages and Disadvantages, Types of Distributed Database Systems, Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Five Level Schema Architecture, Query Processing, Concurrency Control and Recovery in Distributed Databases. Commercial Databases: Commercial Database Products, Familiarity with IBM DB2 Universal Database, Oracle, Microsoft SQL Server, MySQL, their features.	8	ATL5 ATL7 ATL9
	Total Hours	30	

ADDITIONAL RESOURCES

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				END SEM Unive rsity Exam	Tw o Te rm Ex am	Te ac he rs As ses sm ent *	END SEM Unive rsity Exam	Te ac he rs As ses sm ent *				
MTCS202 N	DCC	Advance Database Management System	Max	60	20	20	30	20	2	0	2	3
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A. Value addition to course content/ Skill enhancement content:

<https://education.oracle.com/oracle-database-foundations>

B. Remedial classes for slow learners:

As per the AUMP SOP for slow and fast learners.

SUGGESTED READINGS:

Textbooks

1. C. J. Date, *An Introduction to Database Systems*, 8th ed. Boston, MA, USA: Addison-Wesley, 2003.
2. A. Silberschatz, H. F. Korth, and S. Sudarshan, *Database System Concepts*, 6th ed. New York, NY, USA: McGraw-Hill Education, 2011.

Reference Books

1. P. O'Neil and E. O'Neil, *Database: Principles, Programming, and Performance*, 2nd ed. San Francisco, CA, USA: Morgan Kaufmann Publishers, 2001.
2. M. L. Gillenson, *Fundamentals of Database Management Systems*. Hoboken, NJ, USA: Wiley India, 2005.
3. S. Ceri and G. Pelagatti, *Distributed Databases: Principles and Systems*. New York, NY, USA: McGraw-Hill, 1984.
4. P. Ponniah, *Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals*, 2nd ed. Hoboken, NJ, USA: Wiley India, 2010.

Suggested resources (Websites/e-books)

- 1 J. Han, M. Kamber, and J. Pei, *Data Mining: Concepts and Techniques*, 3rd ed. Waltham, MA, USA: Elsevier/Morgan Kaufmann, 2011.

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			Ma rks	THEORY			PRACTICAL					
				END SEM Unive rsity Exam	Tw o Te rm Ex am	Te ac he rs As ses sm ent *	END SEM Unive rsity Exam	Te ac he rs As ses sm ent *				
MTCS202 N	DCC	Advance Database Management System	Max	60	20	20	30	20	2	0	2	3
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LIST OF PRACTICAL

	Title	CO Mapping
1.	Distributed Database for Bookstore.	CO1
2.	Deadlock Detection Algorithm for distributed database using wait- for graph.	CO1
3.	Object Oriented Database – Extended Entity Relationship (EER).	CO1
4.	Parallel Database – University Counselling for Engineering colleges.	CO2
5.	Parallel Database – Implementation of Parallel Join & Parallel Sort.	CO2
6.	Active Database – Implementation of Triggers & Assertions for Bank Database.	CO3
7.	Deductive Database – Constructing Knowledge Database for Kinship Domain (Family Relations).	CO3
8.	Study and working of WEKA Tool.	CO4
9.	Query Processing – Implementation of an Efficient Query Optimizer.	CO4
10.	Designing XML Schema for Company Database.	CO5

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcomes	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	3	-	-	-	1	1	-	3	2	1	1
CO2	3	3	2	2	3	2	-	3	2	2	1	3	3	1	3
CO3	3	3	3	3	3	2	1	2	3	2	2	3	3	2	3
CO4	2	1	2	1	2	3	2	2	3	3	2	3	1	2	3
CO5	2	1	3	1	2	2	1	2	3	2	2	3	3	2	3

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M.Tech CSE/ CSE(/DS/BDA/AI) / DS / BDA / AI / IS

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTRM301	AECC	Research Methodology in Engineering	Max	60	20	20	0	0	3	1	0	4
			Min	24	16		0	45				

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COURSE OBJECTIVES:

The student will have ability to:

1. The ensuing knowledge as property.
2. To plan and design business research using scientific and statistical methods.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** Demonstrate understanding of research methodology.
- CO2** Apply the statistical concepts in business research.
- CO3** Validate statistical statements relating to business research.

TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
- T2** ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1** Quiz
- ATL2** Activity Based Learning
- ATL3** Midterm Exams
- ATL4** Flip Class
- ATL5** Seminar Presentation
- ATL6** Assignments
- ATL7** Poster
- ATL8** Oral Viva-voce examination
- ATL9** Industrial Visit Report

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Choice Based Credit System (CBCS) in the light of NEP-2020

M.Tech CSE/ CSE/(DS/BDA/AI) / DS / BDA /AI / IS

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTRM301	AECC	Research Methodology in Engineering	Max	60	20	20	0	0	3	1	0	4
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Business Research 1. An overview: Research process 2. Types of Research - Exploratory Research, Descriptive Research, Causal Research, Analytical Research 3. Problem formulation, Management problem v/s. Research problem 4. Approaches to Research 5. Importance of literature review 6. Business Research Design: Steps involved in a research design	10	ATL1 ATL2 ATL6
II	Sampling and Data Collection 1. Sampling and sampling distribution: Meaning, Steps in Sampling process 2. Types of Sampling - Probability and Non probability Sampling Techniques 3. Data collection: Primary and Secondary data – Sources – Advantages/Disadvantages 4. Data collection Methods: Observations, Survey, Interview and Questionnaire design, Qualitative Techniques of data collection.	9	ATL2 ATL8
III	Measurement and Scaling Techniques 1. Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale, Criteria for good measurement 2. Attitude measurement – Likert's Scale, Semantic Differential Scale, Thurstone-equal appearing interval scale	8	ATL1 ATL6
IV	Statistical Tools for Data Analysis 1. Measures of central tendency - Mean, Median, Mode ,Quartiles, Deciles and Percentiles	7	ATL5 ATL7

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SEMESTER-II (2026-28)

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			Marks	THEORY			PRACTICAL					
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MTRM301	AECC	Research Methodology in Engineering	Max	60	20	20	0	0	3	1	0	4
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

	2. Measures of Dispersion: Standard Deviation – Variance – Coefficient of Variance, Skewness 3. Correlation - Karl Pearson's coefficient of Correlation, Rank Correlation 4. Regression: Method of Least Squares 5. Formulation of hypothesis 6. Testing of hypothesis 7. Type I and Type II Errors. 8. Parametric tests: Z-Test, t-test, F-test, Analysis of Variance – One-Way and Two-way classification. 9. Non parametric tests - Chi-Square test		
V	Report writing 1.Reporting Research 2.Types of reports 3.Characteristics of a research report	8	ATL4 ATL9
	Total Hours	30	

ADDITIONAL RESOURCES

A. Value addition to course content/ Skill enhancement content:

<https://nptel.ac.in/courses/109105196>

B. Remedial classes for slow learners:

As per the SVVV SOP for slow and fast learners.

SUGGESTED READINGS:

Textbooks

1. N. K. Malhotra, *Marketing Research: An Applied Orientation*, 6th ed. Noida, India: Pearson Education, 2008.
2. W. G. Zikmund, B. J. Babin, J. C. Carr, and M. Griffin, *Business Research Methods*, 7th ed. New Delhi, India: Cengage Learning, 2003

Reference Books

1. D. R. Cooper and P. S. Schindler, *Business Research Methods*, 9th ed. New York, NY, USA: McGraw-

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			Marks	THEORY			PRACTICAL					
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MTRM301	AECC	Research Methodology in Engineering	Max	60	20	20	0	0	3	1	0	4
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Hill Education, 2006.

2. D. R. Anderson, D. J. Sweeney, T. A. Williams, and J. D. Camm, *Statistics for Business and Economics*, 12th ed. Boston, MA, USA: Cengage Learning, 2014.
3. O. R. Krishnaswami and M. Ranganatham, *Methodology of Research in Social Sciences*. Mumbai, India: Himalaya Publishing House, 2011.
4. R. I. Levin and D. S. Rubin, *Statistics for Management*, 7th ed. New Delhi, India: Dorling Kindersley (India) Pvt. Ltd., 2008.
5. U. Sekaran and R. Bougie, *Research Methods for Business: A Skill Building Approach*, 4th ed. New Delhi, India: Wiley India, 2003.

Suggested resources (Websites/e-books)

- 1 S. P. Gupta, *Statistical Methods*, 43rd ed. New Delhi, India: Sultan Chand & Sons, 2014.
- 2 A. D. Aczel and J. Sounderpandian, *Complete Business Statistics*, 7th ed. New Delhi, India: Tata McGraw-Hill, 2008.

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcome s	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	3	-	-	-	1	1	-	3	2	1	1
CO2	3	3	2	2	3	2	-	3	2	2	1	3	3	1	3
CO3	3	3	3	3	3	2	1	2	3	2	2	3	3	2	3

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Choice Based Credit System (CBCS) in the light of NEP-2020

M.Tech CSE (BDA/DATA SCIENCE)/BDA/DS

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2031	DSE	Optimization Techniques for Analytics	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Develop a Comprehensive Understanding.
2. Master Data Preparation and Modeling.
3. Apply Advanced Analytics Techniques.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** Proficiency in Data Analytics Lifecycle.
- CO2** Hands-On Data Preparation and Analysis Skills.
- CO3** Advanced Analytical Techniques Application.

TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
- T2** ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1** Quiz
- ATL2** Activity Based Learning
- ATL3** Midterm Exams
- ATL4** Flip Class
- ATL5** Seminar Presentation
- ATL6** Assignments
- ATL7** Poster
- ATL8** Oral Viva-voce examination
- ATL9** Industrial Visit Report

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Choice Based Credit System (CBCS) in the light of NEP-2020

M.Tech CSE (BDA/DATA SCIENCE)/BDA/DS

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2031	DSE	Optimization Techniques for Analytics	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

PREREQUISITES:

Machine Learning

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Introduction to Data Analytics and Lifecycle: Data Analytics Lifecycle overview: Key Roles for a Successful Analytics, Background and Overview of Data Analytics Lifecycle, Discovery: Learning the Business Domain, Resources Framing the Problem, Identifying Key Stakeholders. Interviewing the Analytics Sponsor, Developing Initial Hypotheses Identifying, Potential Data Sources Project.	8	ATL1 ATL6
II	Data Preparation: Preparing the Analytic Sandbox, Performing ETLT, Learning About the Data, Data Conditioning, Survey and visualize, Common Tools for the Data Preparation Phase. Model Planning: Data Exploration and Variable Selection, Model Selection, Common Tools for the Model Planning Phase. Model Building: Common Tools for the Model Building Phase.	8	ATL4 ATL8
III	Introduction to simple Linear Regression: The Regression Equation, Fitted value and Residuals, Least Square Introduction to Multiple Linear Regression: Assessing the Model, Cross-Validation, Model Selection and Stepwise Regression, Prediction Using Regression. Logistic Regression: Logistic Response function and logic, Logistic Regression and GLM, Generalized Linear model, predicted values from Logistic Regression, Interpreting the coefficients and odds ratios.	10	ATL2 ATL8
IV	Text Analytics: History of text mining, Roots of text mining overview of seven practices of text analytic, Application and use cases for Text mining: extracting meaning from unstructured text, Summarizing Text. Text Analysis Steps, A Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency—Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments, Gaining Insights.	10	ATL2 ATL6

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2031	DSE	Optimization Techniques for Analytics	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

V	Optimization: Introduction to Optimization, Unconstrained and Linear Constrained Optimization, Non-linear Constrained Optimization, Robust Optimization Techniques.	8	ATL7 ATL9
Total Hours		30	

ADDITIONAL RESOURCES

A. Value addition to course content/ Skill enhancement content:

<https://www.coursera.org/learn/discrete-optimization>

B. Remedial classes for slow learners:

As per the SVVV SOP for slow and fast learners.

SUGGESTED READINGS:

Textbooks

- E. P. K. Chong and S. H. Żak, *An Introduction to Optimization*, 4th ed. Hoboken, NJ, USA: Wiley, 2013.
- D. P. Bertsekas, *Nonlinear Programming*, 3rd ed. Belmont, MA, USA: Athena Scientific, 2016. .

Reference Books

- R. W. Cottle and M. N. Thapa, *Linear and Nonlinear Optimization*. New York, NY, USA: Springer, 2017. ISBN: 978-1-4939-7053-7.
- G. Cornuéjols and R. Tütüncü, *Optimization Methods in Finance*. Cambridge, U.K.: Cambridge University Press, 2013.

Suggested resources (Websites/e-books)

- D. G. Luenberger and Y. Ye, *Linear and Nonlinear Programming*, 4th ed. New York, NY, USA: Springer, 2016.

LIST OF PRACTICAL

	Title	CO Mapping
1.	Conduct mock interviews with stakeholders to frame a business problem and develop	CO1

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SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2031	DSE	Optimization Techniques for Analytics	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

	initial hypotheses for a data analytics project.	
2.	Prepare an analytic sandbox, perform ETLT (Extract, Transform, Load, and Transform), and visualize the dataset using common tools.	CO1
3.	Explore a given dataset, select relevant variables for model planning, and document the rationale behind your selections.	CO2
4.	Implement a simple linear regression model using a provided dataset, analyze the fitted values and residuals, and interpret the results.	CO2
5.	Develop a multiple linear regression model, assess the model, perform cross-validation, and use stepwise regression for variable selection.	CO3
6.	Text Analytics Application.	CO3
7.	Solve an unconstrained and linear constrained optimization problem using robust optimization techniques.	CO3
8.	Optimization Problem Solving: Solve an unconstrained and linear constrained optimization problem using robust optimization techniques.	CO3
9.	Comprehensive Data Analytics Project.	CO3

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcomes	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	3	-	-	-	1	1	-	3	2	1	1
CO2	3	3	2	2	3	2	-	3	2	2	1	3	3	1	3
CO3	3	3	3	3	3	2	1	2	3	2	2	3	3	2	3

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2032	DSE	Data Management for Machine Learning	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Identify and describe various data sources, data preprocessing techniques, and data visualization methods.
2. Explain the concepts and functions of data structures, algorithms, and database management systems.
3. Apply machine learning algorithms and performance metrics to analyze and visualize datasets.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** Understand and explain the principles of data collection, preprocessing, and visualization techniques.
- CO2** Analyze data structures and algorithms, interpreting their complexity and efficiency in real-world data processing tasks.
- CO3** Apply machine learning techniques and evaluate their performance using appropriate metrics, addressing issues of over fitting and dimensionality reduction.

TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
- T2** ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1** Quiz
- ATL2** Activity Based Learning
- ATL3** Midterm Exams
- ATL4** Flip Class
- ATL5** Seminar Presentation
- ATL6** Assignments

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MTCS2032	DSE	Data Management for Machine Learning	Max	60	20	20	30	20	2	0	2	3
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Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

ATL7 Poster

ATL8 Oral Viva-voce examination

ATL9 Industrial Visit Report

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Data Analysis and Visualization Techniques Data Collection: Various sources and types of data: text, video, audio, biology etc; Data Preprocessing: Cleaning data, missing data imputation, noise elimination, feature selection and dimensionality reduction (PCA, tSNE, UMAP), normalisation. Data Visualization: histogram, pie chart, area-plot, box plot, scatter-plot, bubble plot, waffle charts.	10	ATL2 ATL5 ATL7
II	Data Structure and Algorithm Data Structure: Stack, Queue, Linked List, Graphs. Algorithms. Searching, Sorting, Graph traversal, Complexity (Time).	9	ATL1 ATL3 ATL8
III	Database Management System Database: Schema, ER diagram, SQL (Postgresql), database normalization (1NF, 2NF, 3NF and BCNF), indexing (B+tree), transaction concept and simple transaction model, serializability concept, concurrency control.	8	ATL3 ATL6
IV	Foundations of machine learning: Regression Vs. Classification, Generalization, Training, Validation and Testing, Problem of Over fitting and mechanisms to overcome over fitting, Bias Vs. Variance, vector independence, matrices and vector spaces, probability recap – conditional and joint.	7	ATL3 ATL8
V	Performance metrics: Classification, Regression & Clustering, Data Dimensionality – Curses of dimensionality, dimensionality reduction techniques. Machine learning algorithms applied for signal and image analysis.	8	ATL5 ATL7 ATL9

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MTCS2032	DSE	Data Management for Machine Learning	Max	60	20	20	30	20	2	0	2	3
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Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

	Total Hours	30	
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ADDITIONAL RESOURCES

A. Value addition to course content/ Skill enhancement content:

<https://www.cloudskillsboost.google>

B. Remedial classes for slow learners:

As per the SVVV SOP for slow and fast learners.

SUGGESTED READINGS:

Textbooks

1. B. Shive, Data Engineering: *A Novel Approach to Data Design*. Ramsey, NJ, USA: Technics Publications, 2014. ISBN: 978-1935504603.
2. J. Grus, *Data Science from Scratch: First Principles with Python*, 2nd ed. Sebastopol, CA, USA: O'Reilly Media, 2019. ISBN: 978-1492041139. .

Reference Books

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, *Introduction to Algorithms*, 3rd ed. Cambridge, MA, USA: MIT Press, 2009. ISBN: 978-0262033848.
2. A. Silberschatz, H. F. Korth, and S. Sudarshan, *Database System Concepts*, 6th ed. New York, NY, USA: McGraw-Hill Education, 2011. ISBN: 978-0073523323.
3. D. Cielen, A. Meysman, and M. Ali, *Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools*. New Delhi, India: Dreamtech Press, 2016. ISBN: 978-9351199373.

Suggestede- resources (Websites/e-books)

1

LIST OF PRACTICAL

	Title	CO Mapping
1.	Collect and analyze data from various sources, including text, video, audio, and biological data.	CO1
2.	Perform data cleaning, handle missing data imputation, and eliminate noise from a	CO1

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Choice Based Credit System (CBCS) in the light of NEP-2020

M.Tech CSE (BDA/DATA SCIENCE)/BDA/DS

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2032	DSE	Data Management for Machine Learning	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

	given dataset.	
3.	Apply PCA, TSNE, and UMAP for feature selection and dimensionality reduction on a sample dataset.	CO1
4.	Create various data visualizations such as histograms, pie charts, area plots, box plots, scatter plots, bubble plots, and waffle charts.	CO2
5.	Implement and manipulate basic data structures such as stacks, queues, linked lists, and graphs.	CO2
6.	Implement searching, sorting, and graph traversal algorithms and analyze their time complexity.	CO2
7.	Design a database schema, create an ER diagram, normalize a database, and execute SQL queries using PostgreSQL.	CO2
8.	Develop and evaluate regression and classification models, addressing issues of overfitting, bias, and variance.	CO2
9.	Evaluate the performance of classification, regression, and clustering models using appropriate metrics.	CO3
10.	Apply machine learning algorithms to analyze signal and image data, interpreting the results for practical applications.	CO3
11.		

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcome s	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	3	-	-	-	1	1	-	3	2	1	1
CO2	3	3	2	2	3	2	-	3	2	2	1	3	3	1	3
CO3	3	3	3	3	3	2	1	2	3	2	2	3	3	2	3

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M.Tech CSE (BDA/DATA SCIENCE)/BDA/DS

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2032	DSE	Data Management for Machine Learning	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

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Choice Based Credit System (CBCS) in the light of NEP-2020

M.Tech CSE(/DS/BDA) / DS / BDA

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2033	DSE	Probabilistic Graphical Models	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Develop a Thorough Understanding of Probability and Statistics.
2. Master Probabilistic Graphical Models and Mathematical Modelling.
3. Apply Advanced Regression, Hypothesis Testing and Time Series Analysis Techniques.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** Proficiency in Probability and Estimation Theory.
CO2 Competency in Graphical Models and Mathematical Modelling.
CO3 Expertise in Regression, Hypothesis Testing and Time Series Analysis.

TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
T2 ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1** Quiz
ATL2 Activity Based Learning
ATL3 Midterm Exams
ATL4 Flip Class
ATL5 Seminar Presentation
ATL6 Assignments
ATL7 Poster
ATL8 Oral Viva-voce examination
ATL9 Industrial Visit Report

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Choice Based Credit System (CBCS) in the light of NEP-2020

M.Tech CSE(/DS/BDA) / DS / BDA

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2033	DSE	Probabilistic Graphical Models	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Introduction: Samples, Events, Event space, Probability Space, Random Variables, Independence and Conditional Independence, Conditional Probability, Joint Probability, Bayes' theorem Joint and Marginal Probability, Estimation Theory - Maximum Likelihood Estimators.	10	ATL1 ATL3
II	Probabilistic Graphical Models: Direct and undirected model, Inference from Direct and undirected graphical model, Structured and Unstructured graphical models, Partition Function, D-Separation, Decision Analysis, Decision Trees, Influence Diagrams, Factor Graphs, Sampling from Graphical Models. Markov Process and Markov Chain.	9	ATL6 ATL8
III	Introduction to Mathematical Modelling: Linear system of equations, Eigenvalues and Eigenvectors, Stability of Systems using Eigen value analysis, Taylor series, Numerical differentiation, Numerical integration, Higher order accuracy schemes for integration and differentiation, Ordinary differential equations, Partial Differential Equations, Iterative methods.	8	ATL2 ATL3
IV	Probability: Random Variables & Probability Distributions. Sampling, analysis of sample data Empirical Distributions, Sampling from a Population Estimation, confidence intervals, point estimation--Maximum Likelihood, Probability mass functions, Modeling distributions, Hypothesis testing- Z, t, Chi-Square. ANOVA & Designs of Experiments - Single, Two factor ANOVA, Factorials ANOVA models.	7	ATL2 ATL6
V	Regression: Correlation & Regression Models-linear regression methods, Ridge regression, LASSO, univariate and Multivariate Linear Regression, probabilistic interpretation, Regularization, Logistic regression, locally weighted regression. Exploratory data analysis, Time series analysis, Analytical methods – ARIMA and SARIMA.	8	ATL2 ATL6 ATL9

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2033	DSE	Probabilistic Graphical Models	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

	Total Hours	30	
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ADDITIONAL RESOURCES

- A. Value addition to course content/ Skill enhancement content:**
<https://www.coursera.org/specializations/probabilistic-graphical-models>
- B. Remedial classes for slow learners:**
 As per the SVVV SOP for slow and fast learners.

SUGGESTED READINGS:

Textbooks

- D. Koller and N. Friedman, *Probabilistic Graphical Models: Principles and Techniques*. Cambridge, MA, USA: MIT Press, 2009.
- P. Bruce and A. Bruce, *Practical Statistics for Data Scientists: 50 Essential Concepts*. Sebastopol, CA, USA: O'Reilly Media, 2017. .

Reference Books

- A. B. Downey, *Think Stats: Exploratory Data Analysis in Python*, 2nd ed. Needham, MA, USA: Green Tea Press, 2014.
- J. Faraway, *Extending the Linear Model with R: Generalized Linear, Mixed Effects and Nonparametric Regression Models*, 2nd ed. Boca Raton, FL, USA: CRC Press, 2016.

Suggested resources (Websites/e-books)

- M. Friendly and D. Meyer, *Discrete Data Analysis with R: Visualization and Modeling Techniques for Categorical and Count Data*. Boca Raton, FL, USA: CRC Press, 2015.

LIST OF PRACTICAL

	Title	CO Mapping
1.	Use real-world scenarios to apply Bayes' theorem and calculate conditional probabilities.	CO1
2.	Develop maximum likelihood estimators for different probability distributions and	CO1

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SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2033	DSE	Probabilistic Graphical Models	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

	validate their effectiveness with sample data.	
3.	Construct both directed and undirected probabilistic graphical models using given datasets.	CO1
4.	Perform inference on graphical models, both structured and unstructured, and analyze the results.	CO2
5.	olve linear systems of equations using different numerical methods, and analyze the stability of systems using eigenvalue analysis.	CO2
6.	Perform sampling from different populations, analyze the sample data, and construct empirical distributions.	CO3
7.	Conduct hypothesis tests (Z, t, Chi-Square) and ANOVA for single and two-factor experiments to analyze the significance of results.	CO3
8.	Develop linear, ridge, LASSO, and logistic regression models, and compare their performances using univariate and multivariate data.	CO3

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcomes	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	3	-	-	-	1	1	-	3	2	1	1
CO2	3	3	2	2	3	2	-	3	2	2	1	3	3	1	3
CO3	3	3	3	3	3	2	1	2	3	2	2	3	3	2	3

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Choice Based Credit System (CBCS) in the light of NEP-2020

M.Tech CSE (ARTIFICIAL INTELLIGENCE)/AI/ CSE (DS/BDA)/ DS / BDA

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2041	DSE	Introduction to Statistical Methods	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Understanding Probability and Distributions.
2. Mastering Descriptive Statistics and Estimation Techniques.
3. Applying Regression and Correlation Analysis.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** Proficiency in Probability Concepts and Distributions.
- CO2** Competency in Descriptive Statistics and Estimation.
- CO3** Expertise in Regression and Correlation Analysis.

TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
- T2** ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1** Quiz
- ATL2** Activity Based Learning
- ATL3** Midterm Exams
- ATL4** Flip Class
- ATL5** Seminar Presentation
- ATL6** Assignments
- ATL7** Poster
- ATL8** Oral Viva-voce examination
- ATL9** Industrial Visit Report

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Choice Based Credit System (CBCS) in the light of NEP-2020

M.Tech CSE (ARTIFICIAL INTELLIGENCE)/AI/ CSE (DS/BDA)/ DS / BDA

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2041	DSE	Introduction to Statistical Methods	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Introduction to probability: Probability, conditional probability, independence, Bayes' theorem. Random variables: discrete and continuous, distribution functions and their properties, probability mass and density functions, expectation & moments, moment generating function & its properties. Multiple random variables: joint distributions, marginal and conditional distributions. Discrete probability distributions: Bernoulli, Binomial, Geometric, Negative Binomial, Hypergeometric and Poisson distribution. Continuous probability distributions: Uniform, Exponential, Gamma, Normal & Log-normal distribution.	10	ATL1 ATL3 ATL8
II	Descriptive Statistics: Inferential statistics, population, sample, parameter, statistic, random sample, sampling techniques. Summarizing and Exploring Data: Concept of frequency distribution, measures of central tendency, moments, measures of dispersion/variability, measures of skewness and kurtosis.	9	ATL1 ATL2
III	Estimation: Sampling distributions, basic concepts of inference (estimation & hypothesis testing), point estimation & interval estimation	8	ATL3 ATL6 ATL8
IV	Testing of Hypothesis: Null and alternate hypothesis, simple & composite hypotheses, critical region, N-P lemma, tests for mean, variance and proportion in one and two sample problems. Chi-square goodness of fit test. Introduction to nonparametric test, Contingency table, test of independence.	10	ATL2 ATL5

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Choice Based Credit System (CBCS) in the light of NEP-2020

M.Tech CSE (ARTIFICIAL INTELLIGENCE)/AI/ CSE (DS/BDA)/ DS / BDA

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2041	DSE	Introduction to Statistical Methods	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

V	Regression and Correlation: Simple linear regression, least squares fit and correlation analysis. Tests for slope & correlation, prediction problem, residual plots. Multiple linear regression, Analysis of Variance.	8	ATL2 ATL3 ATL6
Total Hours		30	

ADDITIONAL RESOURCES

A. Value addition to course content/ Skill enhancement content:

<https://www.coursera.org/specializations/statistics-with-python>

B. Remedial classes for slow learners:

As per the SVVV SOP for slow and fast learners.

SUGGESTED READINGS:

Textbooks

- W. W. Hines, D. C. Montgomery, D. M. Goldsman, and C. M. Borror, *Probability and Statistics in Engineering*, 4th ed. Hoboken, NJ, USA: Wiley, 2003.
- V. K. Rohatgi and A. K. M. E. Saleh, *An Introduction to Probability and Statistics*, 2nd ed. Hoboken, NJ, USA: Wiley, 2001.

Reference Books

- S. M. Ross, *Introduction to Probability Models*, 11th ed. Amsterdam, Netherlands: Academic Press, 2014.
- M. R. Spiegel, J. Schiller, and R. A. Srinivasan, *Probability and Statistics*, 4th ed. New Delhi, India: Tata McGraw-Hill Education, 2013.
- R. A. Johnson, *Miller and Freund's Probability and Statistics for Engineers*, 9th ed. Noida, India: Pearson Education, 2011.

Suggested resources (Websites/e-books)

- J. S. Milton and J. C. Arnold, *Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences*, 4th ed. New York, NY, USA: McGraw-Hill, 2003.

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SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2041	DSE	Introduction to Statistical Methods	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

LIST OF PRACTICAL

	Title	CO Mapping
1.	Conduct experiments to calculate probabilities using classical, frequency, and axiomatic approaches. Apply Bayes' theorem to real-world scenarios.	CO1
2.	Implement and analyze the Bernoulli, Binomial, Geometric, Negative Binomial, Hypergeometric, and Poisson distributions using sample data.	CO1
3.	Develop and interpret continuous probability distributions.	CO1
4.	Write Python scripts to perform descriptive statistical analysis and visualize various probability distributions.	CO2
5.	Calculate point estimates and construct confidence intervals for different parameters using sample data. Perform estimation using Python.	CO2
6.	Hypothesis Testing for Means and Variances.	CO2
7.	Chi-Square Goodness of Fit and Independence Tests.	CO2
8.	Simple and Multiple Linear Regression.	CO2
9.	ANOVA and Correlation Analysis.	CO3

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcomes	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	3	-	-	-	1	1	-	3	2	1	1
CO2	3	3	2	2	3	2	-	3	2	2	1	3	3	1	3
CO3	3	3	3	3	3	2	1	2	3	2	2	3	3	2	3

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Choice Based Credit System (CBCS) in the light of NEP-2020

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SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2042	DSE	DATA WAREHOUSING	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Understand the components and architecture of data warehousing and data mining systems.
2. Implement data preprocessing, cleaning, integration, and transformation techniques.
3. Analyze and evaluate clustering methods, classification algorithms, and regression models for data analysis.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** Describe the architecture and functionalities of data warehousing and data mining systems.
- CO2** Implement data extraction, cleanup, and transformation processes using appropriate tools.
- CO3** Evaluate various clustering, classification, and regression methods, assessing their effectiveness in different scenarios.

TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
- T2** ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1** Quiz
- ATL2** Activity Based Learning
- ATL3** Midterm Exams
- ATL4** Flip Class
- ATL5** Seminar Presentation
- ATL6** Assignments
- ATL7** Poster
- ATL8** Oral Viva-voce examination

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Choice Based Credit System (CBCS) in the light of NEP-2020

M.Tech CSE (ARTIFICIAL INTELLIGENCE)/ CSE (DS/BDA)/ DS / BDA

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2042	DSE	DATA WAREHOUSING	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

ATL9 Industrial Visit Report

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Data Warehousing and Business Analysis: Data warehousing Components –Building a Data warehouse –Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.	10	ATL1 ATL2 ATL6
II	Data Mining: Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture OfA Typical Data Mining Systems- Classification Of Data Mining Systems. Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.	9	ATL3 ATL8
III	Classification and Prediction: Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.	8	ATL3 ATL5
IV	Cluster Analysis: Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.	10	ATL2 ATL5 ATL8

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2042	DSE	DATA WAREHOUSING	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

V	Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.	8	ATL7 ATL8 ATL9
	Total Hours	30	

ADDITIONAL RESOURCES

A. Value addition to course content/ Skill enhancement content:

<https://www.coursera.org/specializations/data-warehousing>

B. Remedial classes for slow learners:

As per the SVVV SOP for slow and fast learners.

SUGGESTED READINGS:

Textbooks

1. J. Han, M. Kamber, and J. Pei, *Data Mining: Concepts and Techniques*, 3rd ed. Waltham, MA, USA: Elsevier/Morgan Kaufmann, 2011.
2. A. Berson and S. J. Smith, *Data Warehousing, Data Mining, and OLAP*. New Delhi, India: Tata McGraw-Hill Education, 2007.

Reference Books

1. K. P. Soman, S. Diwakar, and V. Ajay, *Insight into Data Mining: Theory and Practice*. New Delhi, India: Prentice Hall of India, 2006.
2. G. K. Gupta, *Introduction to Data Mining with Case Studies*. New Delhi, India: Prentice Hall of India, 2006.
3. P.-N. Tan, M. Steinbach, and V. Kumar, *Introduction to Data Mining*. Boston, MA, USA: Pearson Education, 2007.

Suggested resources (Websites/e-books)

- 1 I. H. Witten, E. Frank, M. A. Hall, and C. J. Pal, *Data Mining: Practical Machine Learning Tools and Techniques*, 4th ed. Burlington, MA, USA: Morgan Kaufmann, 2016.

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MTCS2042	DSE	DATA WAREHOUSING	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

LIST OF PRACTICAL

	Title	CO Mapping
1.	Build and implement a data warehouse architecture using a sample dataset.	CO1
2.	Perform data extraction, cleanup, and transformation using ETL tools.	CO1
3.	Design and execute OLAP queries for multidimensional data analysis.	CO1
4.	Conduct data preprocessing, cleaning, and integration on raw data.	CO2
5.	Implement frequent item set mining and association rule mining techniques.	CO2
6.	Classify data using decision tree and Bayesian classification methods.	CO2
7.	Evaluate the accuracy and error measures of different classifiers.	CO2
8.	Apply partitioning, hierarchical, and density-based clustering methods to a dataset.	CO3
9.	Analyze multimedia and spatial data using data mining techniques.	CO3
10.	Perform text mining and web mining on real-world data sources.	CO3

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcome s	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	3	-	-	-	1	1	-	3	2	1	1
CO2	3	3	2	2	3	2	-	3	2	2	1	3	3	1	3
CO3	3	3	3	3	3	2	1	2	3	2	2	3	3	2	3

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M.Tech CSE (ARTIFICIAL INTELLIGENCE)/AI/CSE (DS/BDA)/ DS / BDA

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2043	DSE	Ethics for Data Science	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Understand the Fundamentals of Ethics.
2. Analyze Ethical Implications of AI and Technology.
3. Apply Ethical Principles in Real-world Scenarios.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** Comprehend Key Ethical Concepts.
CO2 Evaluate Ethical Challenges in AI and Technology.
CO3 Implement Ethical Practices.

TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
T2 ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1** Quiz
ATL2 Activity Based Learning
ATL3 Midterm Exams
ATL4 Flip Class
ATL5 Seminar Presentation
ATL6 Assignments
ATL7 Poster
ATL8 Oral Viva-voce examination

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2043	DSE	Ethics for Data Science	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

ATL9 Industrial Visit Report

PREREQUISITES:

Basic Computer Knowledge

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Introduction to Ethics: What are Ethics?, History, Concept of Informed Consent, Data Ownership, Privacy, Anonymity, Data Validity, Algorithmic Fairness, Societal Consequences, Code of Ethics, Attributions.	10	ATL1 ATL4 ATL6
II	Ethics in the age of AI: Artificial Intelligence Algorithms Models and Limitations, Artificial Intelligence Data Fairness and Bias, Artificial Intelligence Privacy and Convenience, Artificial Intelligence Ethics in Action, The Complex World of Data, The Challenges & Strategies of Putting Ethics into Practice.	9	ATL2 ATL5 ATL8
III	Ethics, Technology, and Engineering – Eindhoven: Introduction, Codes of Conduct, Normative Ethics, The Ethical Cycle, Ethical Questions in the Design of Technology, Designing Morality, Ethical Aspects of Technological Risks, Distribution of Responsibility.	8	ATL4 ATL5 ATL6
IV	Data Ethics, AI, and Responsible Innovation: Getting Started and Big Data Opportunities, Big Data Limitations, Research Ethics, Law and Ethics, Crime and Justice, Home and City, Money and Markets, Life and Health.	10	ATL2 ATL8
V	Ethical Implications of Emerging Technologies: New and upcoming technologies and their potential impact on society. Ethical Challenges and Considerations, Case Studies of Emerging Technologies, Regulation and Policy, Future Directions in Technology Ethics.	8	ATL7 ATL9
Total Hours		30	

ADDITIONAL RESOURCES

A. Value addition to course content/ Skill enhancement content:

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2043	DSE	Ethics for Data Science	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

<https://www.coursera.org/learn/data-science-ethics>

B. Remedial classes for slow learners:

As per the SVVV SOP for slow and fast learners.

SUGGESTED READINGS:

Textbooks

1. D. Raji, "How our data encodes systematic racism," *MIT Technology Review*, Dec. 10, 2020.

Reference Books

1. M. Loukides, H. Mason, and D. J. Patil, *Ethics and Data Science*. Sebastopol, CA, USA: O'Reilly Media, 2018, ch. 3, "The Five Cs."
2. M. Zook, S. Barocas, K. Crawford, E. Keller, A. Goodman, R. Hollander, B. A. Koenig, J. Metcalf, A. Narayanan, A. Nelson, and F. Pasquale, "Ten simple rules for responsible big data research," *PLOS Computational Biology*, vol. 13, no. 3, pp. 1–10, Mar. 2017.

Suggested resources (Websites/e-books)

1. American Civil Liberties Union, "Scary Pizza" [Video]. YouTube, 2004. Available: <https://www.youtube.com/watch?v=33CIVjvYyEk>. Accessed: Jun. 14, 2026.

LIST OF PRACTICAL

	Title	CO Mapping
1.	Facebook-Cambridge Analytica Scandal: This case study explores the misuse of data by Cambridge Analytica, which harvested personal data from millions of Facebook users without their consent. It raises issues of data ownership, privacy, informed consent, and the societal consequences of data misuse.	CO1
2.	COMPAS Recidivism Algorithm: This case study examines the use of the COMPAS algorithm in the US criminal justice system to predict recidivism rates. It highlights issues of algorithmic fairness, bias, and the ethical implications of using AI in decision-making processes that affect people's lives.	CO1

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS2043	DSE	Ethics for Data Science	Max	60	20	20	30	20	2	0	2	3
			Min	24	16		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

3.	Volkswagen Emissions Scandal: This case study discusses the ethical breaches by Volkswagen when they installed software in diesel engines to cheat emissions tests. It covers topics such as codes of conduct, normative ethics, the ethical cycle, and the distribution of responsibility in technological design.	CO2
4.	Google Street View Privacy Concerns: This case study explores the privacy issues raised by Google's Street View project, which involved capturing images of streets and homes worldwide. It addresses the balance between innovation and privacy, research ethics, and the societal impact of big data projects.	CO3
5.	CRISPR Gene Editing: This case study examines the ethical challenges and considerations surrounding the use of CRISPR technology for gene editing. It discusses the potential impact on society, regulation and policy, and the future directions in technology ethics.	CO3

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcome s	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	3	-	-	-	1	1	-	3	2	1	1
CO2	3	3	2	2	3	2	-	3	2	2	1	3	3	1	3
CO3	3	3	3	3	3	2	1	2	3	2	2	3	3	2	3

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS207	SEC	PYTHON FOR DATA SCIENCE LAB	Max	0	0	0	0	50	0	0	2	1
			Min	0	0	0	45					

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

- To explore the programming skills relevant to data science and to gain knowledge of various libraries and packages like NumPy, Pandas and Matplotlib required for data analysis, data visualization, natural language processing and machine learning.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** To understand data types in python and to apply array concepts using NumPy.
- CO2** Structuring data using NumPy and manipulating the data using Pandas.
- CO3** Using Pandas to analyze and work with data sets.
- CO4** Graphical visualization of data using Matplotlib.

TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
- T2** ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

- ATL1** Quiz
- ATL2** Activity Based Learning
- ATL3** Midterm Exams
- ATL4** Flip Class
- ATL5** Seminar Presentation
- ATL6** Assignments
- ATL7** Poster
- ATL8** Oral Viva-voce examination

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS207	SEC	PYTHON FOR DATA SCIENCE LAB	Max	0	0	0	0	50	0	0	2	1
			Min	0	0	0	45					

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

ATL9 Industrial Visit Report

PREREQUISITES:

Programming

SYLLABUS:

Module	Descriptors/Topics	Hours	Assessment Tools
I	Compilation v/s Interpretation: Script mode and Interactive mode · Command Line Arguments, Data Types: Numbers, string, bool, Advanced Data Types: list, tuple set, dictionary, Type casting: implicit, explicit.	10	ATL1 ATL3
II	Function: User defined function, Built in functions, Lambda Function: filter, reduce, map, reverse function, doc string, types of arguments: positional, default, keyword, variable length, variable length keyword.	9	ATL2 ATL8
III	Exception Handling: User defined exception handler, disadvantages of having single except block, grouping multiple exception in single except block, printing the default message of exception by aliasing, optional else block, propagation of exception object.	8	ATL2 ATL8
IV	File handling: Reading a file, modes of file, closing a file, context managers in python, reading file contents line by line, reading a single line in a file, reading a multiple lines in a file, reading a character in a line, readline().	10	ATL2 ATL6
V	OOPS concepts: Encapsulation, polymorphism, inheritance, abstraction, operator overloading and magical methods, multi threading in python.	8	ATL5 ATL7 ATL9
Total Hours		30	

ADDITIONAL RESOURCES

A. Value addition to course content/ Skill enhancement content:

<https://www.kaggle.com/learn/python>

B. Remedial classes for slow learners:

As per the SVVV SOP for slow and fast learners.

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			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS207	SEC	PYTHON FOR DATA SCIENCE LAB	Max	0	0	0	0	50	0	0	2	1
			Min	0	0		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

SUGGESTED READINGS:

Textbooks

1. J. VanderPlas, *Python Data Science Handbook: Essential Tools for Working with Data*. Sebastopol, CA, USA: O'Reilly Media, 2017.
2. M. A. Hameed, *Python for Data Science*. Hoboken, NJ, USA: Wiley, 2021.

Reference Books

1. Daniel, *Python for Data Science: The Ultimate Step-by-Step Guide to Python Programming*. Sebastopol, CA, USA: O'Reilly Media, 2021.
2. Computer Science Academy, *Python for Data Science: A Crash Course for Data Science and Analysis, Python Machine Learning and Big Data*. Independently Published, 2021

Suggested resources (Websites/e-books)

1. P. Barry, *Head First Python*, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2023.

LIST OF PRACTICAL

	Title	CO Mapping
1.	Write a program to demonstrate a) Different numeric data types and b) To perform different Arithmetic Operations on numbers in Python.	CO1
2.	Write a program to create, append, and remove lists in Python.	CO1
3.	Write a program to demonstrate working with tuples in Python.	CO1
4.	Write a program to demonstrate working with dictionaries in Python.	CO1
5.	Write a program to demonstrate a) arrays b) array indexing such as slicing, integer array indexing and Boolean array indexing along with their basic operations in NumPy.	CO1,02
6.	Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.	CO2,03
7.	Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be the input that to be written to the second file.	CO1

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Shri Vaishnav Institute of Information Technology

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Tech CSE(/DS/BDA/AI/) / DS / BDA /AI

SEMESTER-II (2026-28)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCS207	SEC	PYTHON FOR DATA SCIENCE LAB	Max	0	0	0	0	50	0	0	2	1
			Min	0	0		0	45				

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

8.	Write a program to demonstrate Regression analysis with residual plots on a given data set.	CO3,04
9.	Write a program to demonstrate the working of the decision tree-based ID3 algorithm.	CO3
10.	Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file.	CO3,04

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcome s	Correlation with POs												Correlation with PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	3	-	-	-	1	1	-	3	2	1	1
CO2	3	3	2	2	3	2	-	3	2	2	1	3	3	1	3
CO3	3	3	3	3	3	2	1	2	3	2	2	3	3	2	3
CO4	2	3	2	-	3	2	2	1	3	3	1	3	3	3	2

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