

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB
(Formerly West Bengal University of Technology)

Syllabus for B. Sc. in Data Science
(Effective for Academic session 2019-20)

1st SEMESTER

BSCDA-101: ENGLISH

Objectives

To enable the students to:

- Gain the knowledge of English language and also the ability to apply them in the enterprise reality

Units	Course Content
1	Grammatical Focus : Grammatical & Structural aspects covering Parts of Speech, Tense, Voice, Clause, Preposition, Degrees of Comparison, Synonyms & Antonyms, etc; Identifying & Analyzing Grammatical Errors including errors in Spelling & Punctuation.
2	Reading : Vocabulary Building; Comprehension; Interpretation; Summarizing
3	Writing : Letter Writing – Formal, Informal; Accepting & Declining Invitations; Paragraph Writing, Precise Writing, Essay Writing
4	Speaking : Interactive Communication like Introducing Self, Greetings, Conversations, etc; Pronunciation : appropriate stress, intonation, clarity
5	Listening : Understanding – Spoken English, Formal English; Exercises

References

- Leo Jones, Richard Alexander : New International Business English (Communication Skills in English for Business Purposes), Cambridge University Press.
- 1. NCERT, Knowing about English – A Book of Grammar & Phonology **National Building Code of India**, Bureau of Indian Standards, New Delhi, 1999
- 2. NCERT, Working with English – A Workbook,
- 3. A.E. Augustine & K.V. Joseph : Macmillan Grammar – A Handbook, Macmillan
- 4. Krishna Mohan & N.P. Singh : Speaking English Effectively, Macmillan

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BSCDA – 102: DISCRETE MATHEMATICS

Objectives

To enable the students to:

- Develop Mathematical thinking in Computer Science.
- Understanding Combinatorics and Probability.
- Understand the concept of Graph theory.
- Understand number theory and cryptography.

Units	Course Content
1	Mathematical thinking in Computer Science Induction, Recursion, Logic, Invariants, Examples, Optimality
2	Combinatorics and Probability Basic Probability and Venn diagram, Compound Probability of independent events, Dependant events, Permutations and Combinations, Probability using Combinatorics
3	Introduction to Graph theory Fundamental Concepts and Basic Results, Graph Isomorphism, Subgraphs, the Complement of a Graph, Bipartite Graphs and Trees, Vertex-Colourings of Graphs, Matchings in Bipartite Graphs, Eulerian Multigraphs and Hamiltonian Graphs, Digraphs and Tournaments
4	Number theory and Cryptography RSA, key generation, encryption, decryption, cryptographic hash, signing messages
5	Delivery Problem Proof techniques, P vs NP problem

References

1. Discrete Mathematics with Graph theory and Combinatorics, By T Veerarajan.
2. Discrete Mathematics and Graph Theory, By Bhavanari S
3. Discrete Mathematics, By Dhami and Bisht
4. Discrete Mathematics and its Applications, By Kenneth Rosen

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BSCDA – 103: INTRODUCTION TO STATISTICAL THEORY AND METHODS

Objectives

To enable the students to:

- Enable the students to understand the key concepts of Statistics

Units	Course Content
1	Introduction to Statistics: Introduction, Data presentation- Frequency table, histogram, Bar chart and frequency polygons, stem and leaf plots, measure of location and spread, box and whisker plots
2	Introduction: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio. Presentation: tabular and graphic, including histogram and ogives. Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.
3	Bivariate data: Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves. Theory of attributes, consistency of data, independence and association of attributes, measures of association and contingency.

References

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia

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BSCDA – 104: FOUNDATION OF COMPUTER SCIENCE

Objectives	
To enable the students to:	
<ul style="list-style-type: none">Gain the knowledge of computer application in theory and practice and also the ability to apply them in the enterprise reality	
Units	Course Content
1	Basic Computer Concepts – Different generations of computer hardware; Modern taxonomy of computers; Hardware and software; Programming languages; Problem solving and algorithms; Basic computer applications; General idea of information and communication technologies; Information system development process.
2	Computer Hardware – Input and Output devices; Memory (or storage) devices; Central Processing Unit. Input / Output devices: keyboard, mouse, light pen, barcode readers, scanners, MICR, OCR, voice recognition and handwriting recognition systems; visual display terminals, printers, plotters etc. Storage devices: Primary storage – RAM, ROM, EEROM, PROM, EPROM; Secondary storage – direct access devices, serial access devices: hard disks, floppy disks, magnetic tape, CD-ROM, DVD; Cache memory and Virtual memory. Central Processing Unit – Control Unit; Arithmetic and Logic Unit; Decoders; Registers; Machine Instructions; Stored program concept; Program execution: Fetch-Decode-Execute cycle; Arithmetic, logical and shift operations.
3	Computer Software – Meaning of software; broad classification of software; system software and application software; utilities. Systems software – Operating systems: Basic idea of an OS; OS as a resource manager – memory management, input/output management, secondary storage management, processor management, program management, network management; Brief introduction to different types of operating systems like DOS, Windows, Unix, Linux etc. Application software – System development tools, Utilities, Application packages, Userwritten programs.

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4	<p>Programming languages and Algorithms – The concept of programming; pseudocode and flowcharts; structure of programs; program development guidelines; programming languages – machine language, assembly languages, high-level languages (procedural and object-oriented languages), fourth generation languages; object code and executable codes; compilers, translators, assemblers; editing tools such as vi.</p> <p>Algorithms – Basic concept; Some typical algorithms – Finding the sum of a series, solving a quadratic equation, generating Fibonacci sequence, checking whether a number is prime or not, creating an array of numbers and displaying the largest element in the list, sorting a given set of numbers, multiplying together two matrices etc. (The algorithms may be implemented using either pseudocode or a high level programming language).</p>
5	<p>Computer networks and Internet – Basic concepts of computer networks; local area networks and wide area networks; switches, hubs, routers, idea of distributed systems; the Internet and the World Wide Web.</p>
6	<p>Computer Applications: Essential features of computer systems and structures required for office automation, communications, control systems, data acquisition, interactive multimedia, networking, parallel processing and neural networks.</p>

References

1. Mano – Computer System Architecture; Pearson Education
2. Tanenbaum – Structured Computer Organization, Pearson Education
3. Martin & Powell – Information Systems: A Management Perspective; McGraw-Hill
4. Laudon & Laudon – Management Information Systems: Pearson Education
5. Comer: Computer Networks and the Internet: Pearson Education
6. Graham Curtis – Business Information Systems: Addison Wesley.

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BSCDA – 105: DATABASES MANAGEMENT SYSTEM

Objectives	
To enable the students to:	
<ul style="list-style-type: none"> Understand Relational database, its functions and utility and difference between Relational and normal database. 	
Units	Course Content
1	Introduction to Database Systems Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS
2	Entity-Relationship Model Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.
3	SQL and Integrity Constraints Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.
4	Relational Database Design Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF
5	Structure Query Language and Advance SQL Programming Data Manipulation Language on SQL programming to feed and query relation database objects.
6	Transaction and Query Optimisations Transaction in Sql and query optimisation
7	Data Warehousing Concepts Introduction to Data Warehousing, heterogeneous database, Query-Driven Approach, Update-driven approach, tools and utilities
8	Introduction to NoSql Introduction to NoSql, types of NoSql, Advantages of NoSql, Usage

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References

1. Relational Database Management System, By Pankaj Agarwal
2. Inside Relational Databases, By Mark Whitehorn and Bill Marklyn