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SCHEME & SYLLABUS FOR

Bachelor of Vocational Studies (B. Voc.) Data Science

NAAC GRADE B+ Accredited University

nirf RANKING 2024 Ranked in Top 151-200 Universities

Kalinga University, Naya Raipur, Chhattisgarh

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BACHELOR OF VOCATIONAL STUDIES (B. VOC.)

DATA SCIENCE

Semester-I							
Code No.	**Paper**	**L**	**T/P**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total Marks**
BVDS101	Communication Skills	3	0	3	70	30	100
BVDS102	Fundamentals of Information Technology	3	0	3	70	30	100
BVDS103	Descriptive Statistics	3	0	3	70	30	100
BVDS104	Database Management System	3	0	3	70	30	100
BVDS105P	**On Job Training/Internship/ Workshop**	0	36	18	150	50	200
	Total	**12**	**36**	**30**	**430**	**170**	**600**

Semester-II							
Code No.	**Paper**	**L**	**T/P**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total Marks**
BVDS201	Mathematics for Data Science-I	3	0	3	70	30	100
BVDS202	Environmental Studies	3	0	3	70	30	100
BVDS203	Introduction to RDBMS and SQL	3	0	3	70	30	100
BVDS204	Probability & Random Variables	3	0	3	70	30	100
BVDS205P	**On Job Training/Internship/ Workshop**	0	36	18	150	50	200
	Total	**12**	**36**	**30**	**430**	**170**	**600**

Semester-III							
Code No.	**Paper**	**L**	**T/P**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total Marks**
BVDS301	Optimization Techniques	4	0	4	70	30	100
BVDS302	Probability Distributions	4	0	4	70	30	100
BVDS303	Python Programming	3	0	3	70	30	100
BVDS304P	Python Programming-Lab	0	2	1	30	20	50
BVDS305P	**On Job Training/Internship/ Workshop**	0	36	18	150	50	200
	Total	**11**	**36**	**30**	**390**	**160**	**550**

Semester-IV							
Code No.	**Paper**	**L**	**T/P**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total Marks**
BVDS401	Statistical Simulation Techniques	4	0	4	70	30	100
BVDS402	Artificial Intelligence	4	0	4	70	30	100
BVDS403	Statistical Inference	4	0	4	70	30	100
BVDS404P	**On Job Training/Internship/ Workshop**	0	36	18	150	50	200
	Total	**11**	**36**	**30**	**390**	**160**	**550**

Semester-V							
Code No.	**Paper**	**L**	**T/P**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total Marks**
BVDS501	Applied Multivariate Techniques	4	0	4	70	30	100
BVDS502	Data Mining Techniques	4	0	4	70	30	100
BVDS503	Design of Experiments	4	0	4	70	30	100
BVDS504P	**On Job Training/Internship/ Workshop**	0	36	18	150	50	200
	Total	**11**	**36**	**30**	**390**	**160**	**550**

Semester-VI							
Code No.	**Paper**	**L**	**T/P**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total Marks**
BVDS601	Categorical Data Analysis	4	0	4	70	30	100
BVDS602	Stochastic Modeling	4	0	4	70	30	100
BVDS603	Machine Learning and Data Analytics	4	0	4	70	30	100
BVDS604P	**On Job Training/Internship/ Workshop**	0	36	18	150	50	200
	Total	**11**	**36**	**30**	**390**	**160**	**550**

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SEMESTER-I

COMMUNICATION SKILLS

BVDS101

Course Objective

The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions. One of the critical links among human beings and an important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal. In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

Course Outcome:

1. The purpose of this course is to introduce students to the theory, fundamentals and tools of communication
2. To develop vital communication skills which should be integral to personal, social and professional interactions.
3. One of the critical links between human beings.
4. An important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal.
5. In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

CONTENTS

Unit I: Introduction:

Theory of Communication, Types and modes of Communication, Mediums and channels of communication, barriers to communication, English as a Global language, the Lingua Franca, Social influences on English

Unit II: Language of Communication:

Verbal and Non-verbal (Spoken and Written) Personal, Social and Business Barriers and Strategies Intra-personal, Inter-personal and Group communication, Varieties of English, Language, Accent, Dialect, Colloquialism, Historical influences on English

Unit III: Speaking Skills:

Monologue Dialogue Group Discussion Effective Communication/ Mis- Communication Interview Public Speech, Regional influences on English, Convergence and divergence, Linguistic Imperialism,

Unit IV: Reading and Understanding-

Close Reading, Reading analysis of a text - Audience and purpose, Content and theme, Tone and Mood, stylistic devices, structure Comprehension- Analysis and Interpretation Translation(from Indian language to English and vice-versa) Literary/Knowledge Texts

Unit V: Writing Skills

Documenting Report Writing Making notes Letter writing, Writing tabloids, diary entry, open letters, essays, newsletter and magazine articles, skits, short stories, impersonating characters. It will enhance Language of communication, various speaking skills such as personal communication, social interactions and communication in professional situations such as interviews, group discussions and office environments, important reading skills as well as writing skills such as report writing, note taking etc. While, to an extent, the art of communication is natural to all living beings, in today's world of complexities, it has also acquired some elements of science. It is hoped that after studying this course, students will find a difference in their personal and professional interactions.

Recommended Readings:

1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, DrRanjanaKaul, DrBrati Biswas

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FUNDAMENTALS OF INFORMATION TECHNOLOGY

BVDS102

Unit-I

Computer characteristics: Speed, storage, accuracy, diligence; Digital signals, Binary System, ASCII; Historic Evolution of Computers; Classification of computers: Microcomputer, Minicomputer, mainframes, Supercomputers; Personal computers: Desktop, Laptops, Palmtop, Tablet; Hardware & Software; Von Neumann model.

Unit-II

Hardware: CPU, Memory, Input devices, output devices. Memory units: RAM (SDRAM, DDR RAM, RDRAM etc. feature wise comparison only); ROM-different types: Flash memory; Auxiliary storage: Magnetic devices, Optical Devices; Floppy, Hard disk, Memory stick, CD, DVD, CD/DVD-Writer; Input devices - keyboard, mouse, scanner, speech input devices, digital camera, Touch screen Voice Input, Joystick, Optical readers, bar code reader; Output devices: Display device, size and resolution; CRT, LCD, LED; Printers: Dot-matrix, Inkjet, Laser; Plotters, Sound cards & speaker.

Unit-III

Software: System software, Application software; concepts of files and folders, Introduction to Operating systems, Different types of operating systems: single user, multitasking, time-sharing multi-user; Booting, POST; Basic features of two GUI operating systems: Windows & Linux (Basic desk top management); Programming Languages, Compiler, Interpreter, Databases; Application software: Generic Features of Word processors, Spread sheets and Presentation software; Generic Introduction to Latex for scientific typesetting; Utilities and their use; Computer Viruses & Protection, Free software, open source.

Unit-IV

Computer Networks and Internet: Connecting computers, Requirements for a network: Server, Workstation, switch, router, network operating systems; Internet: brief history, World Wide Web, Websites, URL, browsers, search engines, search tips; Internet connections: ISP, Dial-up, cable modem, WLL, DSL, leased line Wireless and Wi-Fi connectivity ; email, email software features (send receive, filter, attach, forward, copy, blind copy); characteristics of web-based systems, Web pages, Web Programming Languages.

Unit-V

Information Technology And Society: Indian IT Act, Intellectual Property Rights, issues. Application of information Technology in Railways, Airlines, Banking, Insurance, Inventory Control, Financial systems, Hotel management, Education, Video games, Telephone exchanges, Mobile phones, Information kiosks, special effects in Movies.

Programming Concepts & Techniques: Program Concept, Characteristics of Programme, Stages in Program Development, Tips for Program Designing, Programming Aids, Algorithms, Pseudo code, Notations, Design, Flowcharts, Symbols, Rules, compiler & Interpreter. Introduction to programming techniques, Top-down & Bottom-up approach, Unstructured, & Modular programming, Cohesion, Coupling, Debugging, Syntax & Logical Errors, Linking and Loading, Testing and Debugging, Documentation.

Reference Books:

1. Programming in C, R.S. Salaria, Khanna Publishing House
2. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing House
3. Handbook of Computer Fundamentals, N.S. Gill, Khanna Publishing House

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DESCRIPTIVE STATISTICS

BVDS103

Unit-I

Definition, Scope, Significance, Limitations. Tabulation, Classification and Graphical representation of data (Pie Chart, Bar Diagram, Histogram, Frequency Polygon, Ogive Curve, etc.).

Unit-II

Measures of Central Tendency – Arithmetic Mean, Median and Mode, Position of averages. Graphical representation of data, Measures of dispersion – range, variance, mean deviation, standard deviation and coeff. of variation ,Concepts and Measures of Skewness and Kurtosis .

Unit-III

Mathematical and Statistical probability, Elementary events, Sample space, Compound events, Types of events, Mutually exclusive, Independent events, addition law of probability, Conditional probability, Multiplication theorem of probability, Baye's Theorem.

Unit-IV

Concept of Random Variable, Probability Mass Function & Density Function, Mathematical Expectation (meaning and properties), Moments, Moment Generating Function and Characteristic Function.

Text/References:

1. Gupta, S.P.: Statistical Methods (1981).
2. Croxton, Cowden & Klein: Applied General Statistics (1973).
3. Kapur and Sexena: Mathematical Statistics (1970)
4. Murry, R. Speigal: Theory and Problems of Statistics (1972)

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DATABASE MANAGEMENT SYSTEM

BVDS104

Unit-I

Basic Concepts: A Historical perspective, File Systems vs. DBMS, Characteristics of the Data Base Approach, Abstraction and Data Integration, Database users, Advantages and Disadvantages of DBMS, Implication of Database approach.

Unit-II

Data Base Systems Concepts and Architecture: Data Models, Schemas and Instances, DBMS architecture and Data Independence, Data base languages & Interfaces, DBMS functions and component modules

Unit-III

Entity Relationship Model: Entity Types, Entity Sets, Attributes & Keys, Relationships, Relationship Types, Roles and Structural Constraints, Design issues, weak entity types, E-R Diagrams. Design of an E-R Database Schema, Reduction of an E-R Schema to Tables. Conventional Data Models: An overview of Network and Hierarchical Data Models. Relational Data Model: Relational model concepts, Integrity constraints over Relations, Relational Algebra

- Basic Operations.

Unit-IV

Relational Data Base Design: Functional Dependencies, Decomposition, Desirable properties of decomposition, Normal forms based on primary keys (1 NF, 2 NF, 3 NF and BC NF). RDBMS: Terminology, The 12 Rules (Codd's Rule) for an RDBMS. Introduction to Data Mining, Its Applications. Concept of Data ware house, Its Architecture, Introduction to Big Data.

Text/References:

1. C.J. Date, "An Introduction of Database System", The Systems Programming Series, 6/Ed, Addison-Wesley Publishing Company, Inc., 1995.
2. Silberscatz, Korth and Sudarshan, "Database System Concepts", Third Ed. McGraw Hill International Editions, Computer Science Series-1997.

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SEMESTER-II

MATHEMATICS FOR DATA SCIENCE-I

BVDS201

Unit-1: Sets and elements – Operations on sets – least upper bounds – Sequence of real numbers – Definition of sequence and sub sequence – Limit of a sequence – Convergent sequence – Bounded sequence –Monotone sequence – Operations on convergent sequence.

Unit-2: Series of real numbers – Convergence and divergence – Series with non negative terms – Alternating series – Conditional convergence and absolute convergence – Tests for absolute convergence.

Unit-3: Functions continuous at a point on the real line – The Derivative – Rolle‟s theorem - Mean value theorem – Taylor‟s theorem – Maclaurin theorem – simple problems.

Unit-4: Riemann Integrability – Upperp and Lower sums – Upper and Lower integral – The Riemann integral – Riemann criterion for integrability – Fundamental theorem of calculus – Improper integral – simple problems. Laplace transform – Laplace transform of- Inverse Laplace transform to the above standard functions – Applications to ordinary differential equation.

Books for Study:

1. Bartle, R.G., &Shebert, Introduction to Real Analysis, Wiley Eastern & Sons,

2. Gold berg, R.R., Methods of Real Analysis, Oxford and IBH,1970.

Books for Reference:

1. Apostol, T.M., Mathematical Analysis, Narosa Publications, 1985.

2. Singaravelu, A., Allied Mathematics, A.R.S. Publications, 2014.

3. Vittal, P.R, Allied Mathematics, Margham Publications, 2015.

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ENVIRONMENTAL STUDIES

BVDS202

Unit 1 : Introduction to Environmental Studies

- Multidisciplinary nature of environmental studies;
- Scope and importance; Concept of sustainability and sustainable development.

Ecosystems

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems :

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 2 : Natural Resources : Renewable and Non--renewable Resources

- Land resources and landuse change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water : Use and over--exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter--state).
- Energy resources : Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 3 : Biodiversity and Conservation

- Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega--biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity : Habitat loss, poaching of wildlife, man--wildlife conflicts, biological invasions; Conservation of biodiversity : In--situ and Ex--situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit 4 : Environmental Pollution

- Environmental pollution : types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Pollution case studies.

Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 5 : Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management : floods, earthquake, cyclones and landslides.
- Environmental movements : Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Suggested Readings:

1. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999.Global Ethics and Environment, London, Routledge.
4. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll.Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36--37.
7. McCully, P. 1996. Rivers no more: the environmental effects of dams(pp. 29--64). Zed Books.

8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.

9. Odum, E.P., Odum, H.T. & Andrews, J. 1971.Fundamentals of Ecology. Philadelphia: Saunders.

10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.

11. Rao, M.N. & Datta, A.K. 1987. Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.

12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012.Environment. 8th edition. John Wiley & Sons.

13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. Environmental law and policy in India. Tripathi 1992.

14. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.

15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.

16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.

17. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.

18. Warren, C. E. 1971. Biology and Water Pollution Control. WB Saunders.

19. Wilson, E. O. 2006.The Creation: An appeal to save life on earth. New York: Norton.

20. World Commission on Environment and Development. 1987.Our Common Future. Oxford University Press.

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INTRODUCTION TO RDBMS AND SQL

BVDS203

Unit- 1: Introduction to database systems, File Systems Versus a DBMS, View of data – Data abstraction, View levels, Data models, Instances and Schemas, Data Independence, Database languages, Database architecture, Database users , Database administrator, Role of DBA . The Entity – Relationship (ER) model Entity sets, Relationship sets, Attributes, Constraints, Mapping Cardinalities, Keys, ER diagrams, Weak entity sets, Strong entity sets.

Unit- 2: Data Definition in SQL Data types, Creation, Insertion, Viewing, Updation, Deletion of tables, modifying the structure of the tables, Renaming, Dropping of tables. Data Constraints – I/O constraints, Primary key, foreign key, unique key constraints, ALTER TABLE command.

Unit- 3: Database Manipulation in SQL Computations done on table data Select command, Logical operators, Range searching, Pattern matching, Grouping data from tables in S QL, GROUP BY, HAVING clauses, Joins – Joining multiple tables, Joining a table to itself. Views Creation, Renaming the column of a view, destroys view, Granting and revoking permissions: Granting privileges, Object privileges, Revoking privileges

Unit- 4: Program with SQL Data types: Using set and select commands, procedural flow, if, if /else, while, goto, global variables, Security Locks, types of locks, levels of locks. Cursors Working with cursors, Error Handling, Developing stored procedures, create, alter and drop, passing and returning data to stored procedures, using stored procedures within queries, building user defined functions, creating and calling a scalar function, implementing triggers, creating triggers , multiple trigger interaction.

References:

1. Fundamentals of Database Systems, Elmasri & Navathe, Pearson Education.

2. Database System Concepts Abraham Silberschatz, Henry F Korth,S.

3. Introduction to Database Systems, CJ Date, Addison Wesley

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PROBABILITY & RANDOM VARIABLES

BVDS204

Unit-1: Introductory Notions of Probability- Random Experiments – Sample Space and Events. Axiomatic Approach to Probability – Addition Law – Problems in Axiomatic Approach.

Unit-2: Combinatorics and Classical Probability Elements of Combinatorics. Classical definition of Probability. Problems in Classical approach.

Unit-3: Conditional Probability – Occupancy Problems. Stochastic Independence and related concepts - Independence of events – Pair wise and Mutual Independence. Multiplication Law, Law of Total Probability, Baye‟s Theorem. Bernoulli Trials – Problems.

Unit-4: Random Variables - Discrete and Continuous Random Variables; Probability mass function and Probability density function- Properties and examples. Cumulative distribution function – Properties and examples; Change of variable (Univariate case).

Books for Study:

1. Gupta, S.C. and Kapoor, V.K. (2002). Fundamentals of Mathematical Statistics. Sultan chand and Sons. New Delhi

2. Parzen, E.(1960). Modern Probability Theory. John Wiley & Sons, New York

Books for Reference:

1. Hogg, R.V. and Craig, A.T. (2002). Introduction to Mathematical Statistics. Pearson

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SEMESTER-III

OPTIMIZATION TECHNIQUES

BVDS301

Unit-1: Introduction to OR - Linear programming problem - Formulation – Graphical method – Basic solution - Optimum solution - Simplex method - Various cases – Unbounded solution -Unrestricted variables, alternative optimum.

Unit-2: Need for artificial variables - Two phase method - Big M method - Primal, Dual relationship – Dual simplex method.

Unit-3: Transportation problem- North-west corner rule – least cost method- Vogel‟s Approximation Method – Modified Method, Assignment problem.

Unit-4: Networks - CPM and PERT - problems. Decision under uncertainty – Laplace criterion - Minimax criterion - Savage criterion – Hurvitz theorem - Games - Two person zero sum games - Saddle point - Solving by graphical method - solving by LPP.

Books for study

1. Don T. Philips, Ravindran, A, James J. Solberg (2007), Operations Research: Principles and Practices, John Wiley & sons.

2. Hadley (2006), Linear Programming, Addison - Wesley publishers.

3. Hamdy A. Taha (2008) Operations Research - An Introduction (fourth edition), Macmillan publishers.

Books for reference:

1. Hillier, F.S. and Lieberman, G.J. (1974), Introduction to Operations Research, Holden Day Publishing, San Francisco.

2. KantiSwarup, Gupta, P.K., Manmohan (1993), Operations Research, Sultan Chand Publishers.

3. Mittal, K.V. (1976), Optimization Methods in Operations Research, Wiley Eastern.

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PROBABILITY DISTRIBUTIONS

BVDS302

Unit-1: Mathematical expectations-definition, raw and central moments (definition and relationships), moment generating function and properties, Probability generating function and characteristic function (definition and basic properties).

Unit- 2: Bivariate random variable, joint pmf and joint pdf, marginal and conditional probability, independence of random variables.

Unit-3: Skewness and kurtosis using moments, conditional mean and variance, covariance, Karl Pearson Correlation coefficient, independence of random variables based on expectation.

Unit- 4: Standard distributions-Degenerate distribution, Discrete type-Bernoulli, Binomial, Poisson, Geometric, negative binomial (definition, properties and applications), Uniform, Continuous type-Uniform, exponential, gamma, Beta, Normal (definition, properties and applications), Lognormal, Pareto and Cauchy (Definition only).

References

1. V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley

Eastern.

2. S.C.Gupta and V. K. Kapoor Fundamentals of Mathematical Statistics, Sultan Chand and

Sons.

3. A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, Mc Graw

Hill.

4. John E Freund, Mathematical Statistics (6th edn), Pearson Edn, New Delhi.

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PYTHON PROGRAMMING

BVDS303

Unit- 1: Introduction to Python: Python Introduction - History of Python – Python features, Python interpreter, Overview of programming in Pytho - Python built in types, Arithmetic - Program input and output, Variables and assignment. Advanced data types :Python Strings and string manipulation Assigning values in strings, String special operators, String formatting operators, Triple Quotes, Raw String, Unicode String, Build-in-String methods. Python List: Introduction - Accessing values in list, List manipulations, List Operations, Indexing, slicing & matrices - Python Dictionary -Introduction, Accessing values, Properties, Functions in Dictionary. Python Tuples: Introduction, Operation, Accessing, Function and methods in tuples and Data Type Conversion.

Unit-2: Python - Basic Operators: Arithmetic Operators, Comparison Operators, Logical (or Relational) Operators, Assignment Operators, Conditional (or ternary) Operators. Conditional Statement: Branching (if, else-if, nested), Looping: while statement, for statements, Control Statements: break, continue and pass Statements. Functions: Defining a function, Calling a function, Types of functions, Function Arguments Anonymous functions -

Global and local variables. Modules: Importing module, Math module Random module. Packages – Composition - Exception Handling

Unit- 3: OOPs concept: Class and object – Attributes – Inheritance - Overloading, Overriding - Data hiding. Regular expressions - Match function, Search function, Modifiers, Patterns. Files: reading and writing files, methods of file objects. Standard library functions - dates and times. GUI Introductions: Introduction to GUI Programming, Tkinter programming, Tkinter widgets. Database: Python database application programmers interface (DB-API), connection and cursor objects. Type objects and constructors - python database adapters - Visualization: Bar chart, Polar plot, Pie Charts, Histograms, Contour Plot, Heat Map.

Unit- 4: Networking: Socket, Socket Module and methods. Client and server Internet modules – Multithreading - Web Services and XML - JSON and the REST Architecture - Web Programming: Creating simple web clients - Introduction to CGI, CGI module, building CGI applications. Python web application frameworks: django.

References:

1. Core Python Programming by Wesley J. Chun, 2nd Edition ,Pearson Education

2. An Introduction to Python by Guido Van Russom, Fred L. Drake, Network Theory Limited.

3. Beginning Python: From Novice To Professional By Magnus Lie Hetland, Second Edition.

4. Programming in Python 3 by Mark Summerfield, Pearson Education

5. Online version of An Introduction To Python

6. http://www.network-theory.co.uk/docs/pytut

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PYTHON PROGRAMMING-LAB

BVDS304P

Course outline

1. Programs using Loops and decisions
2. Programs for constants and String Manipulations
3. Programs for Functions, arrays , tuple, list, Dictionary
4. Programs for Sessions and request handling
5. Programs for Modules, InputOutput,
3. Exception Handling, OOPs concept
6. Programs for Database management, Multithreading Installation of WAMP/XAMPP
4. Server, MySQL db, and Python MySQL interface
7. Exchange of data between web page and server
8. Storage /Retrieval/Updation of form data in MySQL DB

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BVDS305P

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SEMESTER-IV

STATISTICAL SIMULATION TECHNIQUES

BVDS401

Unit- 1: Random numbers: Pseudorandom number generation, Using random numbers to evaluate integrals. Probability integral transformation

Unit- 2: Generating discrete random number variables: The inverse transformation method, generating a Poisson random variable, generating a Binomial random variable, The acceptance-rejection technique, the composition approach, the Alias method for generating discrete random variable. Generating random vectors.

Module 3: Generating continuous random variables: The inverse transformation method, generating uniform random variable, generating Normal random variable, The acceptance rejection technique, the composition approach, the Alias method for generating random variable. Generating random vectors.

Module 4: Multivariate Normal distribution and copulas: Multivariate Normal, Generating Normal random vectors, Copulas. Generating Normal random vectors by copulas.

Reference:

1. Simulation, Fifth Edition 5th Edition Sheldon M. Ross

2. Simulation Modelling and Analysis (Mcgraw-hill Series in Industrial Engineering and Management) by Averill M Law

Reference:

1. Introduction to Probability Models, Eleventh Edition by Sheldon M. Ross

2. Simulation Modelling and Analysis (Mcgraw-hill Series in Industrial by Averill M Law

3. Top 20 MS Excel VBA Simulations!: VBA to Model Risk, Investments, Growth, Gambling, and Monte Carlo Analysis (Save Your Time With MS Excel! Book 6 by Andrei Besedin)

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ARTIFICIAL INTELLIGENCE

BVDS402

Unit- 1: AI: Introduction, Brief history, Agents and rationality, task environments, agent architecture types. Search and Knowledge representation. - Search spaces, Uninformed and informed search, Hill climbing, simulated annealing, genetic algorithms,

Unit- 2: Logic based representations (PL, FoL) and inference, Prolog,Rule based representations, forward and backward chaining, matching algorithms,

Unit- 3: Probabilistic reasoning and uncertainty, Bayes nets and reasoning with them, Uncertainty and methods to handle it.

Unit- 4: Learning - Forms of learning- Statistical methods: naive-Bayes, nearest neighbor, kernel, neural network models, noise and over fitting, Decision trees, inductive learning. Clustering - basic agglomerative, divisive algorithms based on similarity/dissimilarity measures. Expert Systems, Applications to NLP.

Books and References:

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Ed., Prentice Hall, 2009. Can also use 2nd Ed., Pearson Education International, 2003.

2. Nils Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann, 1998.

3. David Poole, Alan Mackworth, Artificial Intelligence: Foundations for Computational Agents, Cambridge Univ. Press, 2010.

Other References:

1. Ronald Brachman, Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.

2. Frank van Harmelen, Vladimir Lifschitz, Bruce Porter (Eds), Handbook of Knowledge Representation, Elsevier, 2008.

3. Ivan Bratko, Prolog Programming for Artificial Intelligence, 4th Ed., Addison-Wesley, 2011.

4. Stephen Marsland, Machine Learning: An Algorithmic Perspective, Chapman and Hall, 2009.

5. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

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STATISTICAL INFERENCE

BVDS403

Unit- 1: Sampling distributions: Parameter, Statistic, standard error, Sampling from normal distribution: distribution of sample mean, sample variance, chi-square, students t distribution, and F distribution (definition, property and relationships only).

Unit-2: Estimation of Parameter: Point Estimation. Desirable properties of a good estimator, unbiasedness, consistency, sufficiency. Methods of Estimation; method of maximum likelihood, method of moments, method of least squares, Concept of Bayesian estimation. Interval Estimation; Large sample confidence interval for mean, equality of means, equality of proportions.

Unit- 3: Testing of Hypotheses; concept of testing hypotheses, simple and composite hypotheses, null and alternative hypotheses, type I and type II errors, critical region, level of significance, power of test. Most powerful tests Uniformly most powerful test, Neyman Pearson Lemma. Likelihood ratio tests, large sample properties, asymptotic distribution of LRT statistic for simple null hypothesis.

Unit- 4: Large sample tests concerning mean, equality of means, proportions, equality of proportions. Small sample tests based on t distribution for mean, equality of means and paired t test. Tests based on F distribution. Teats based on chi square distribution for variance, goodness of fit and for independence of attributes .Test for correlation coefficients.

References

1. V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

2. S.C.Gupta and V. K. Kapoor. Fundamentals of Mathematical Statistics, Sultan Chand and Sons

3. A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill

4. John E Freund, Mathematical Statistics (6th edn), Pearson Edn, NewDelhi

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SEMESTER-V

APPLIED MULTIVARIATE TECHNIQUES

BVDS501

Unit-1: Basics of Matrix and Vector Algebra –Positive Definite Matrices – Square Root Matrix – Random vectors and Matrices – Mean vectors and Covariance Matrices – Matrix Inequalities and Maximization. Multivariate Normal distribution – Properties, Distributions of linear combinations, independence, marginal distributions, conditional distributions, Partial and Multiple correlation coefficient. Moment generating function.

Unit- 2: Maximum likelihood estimation of Mean vector and Variance – Covariance matrix of multivariate Normal distribution. Sampling distribution of mean vector and dispersion matrix. Mahalanobis D2 and Hotelling‟s T2 Statistics. Testing the equality of mean vectors. Testing the independence of subvectors.

Unit- 3: One – way MANOVA. Principal Components - Population Principal Components – Summarizing Sample variation by Principal Components - Scree Plot. Factor Analysis – Orthogonal Factor model, Factor rotation, Factor scores. Canonical Correlation Analysis.

Unit- 4: Discrimination & Classification – Fisher‟s method. Optimality of classification rules. Discrimination & classification for several populations. Cluster Analysis – Similarity measures, Hierarchical & Non-Hierarchical methods.

Books for study:

1. Anderson, T. W. (2003): An Introduction to Multivariate Statistical Analysis – 3rdedn. John Wiley & Sons.

2. Johnson, R. A., &Wichern, D. W. (2007): Applied Multivariate Statistical Analysis – 2ndedn. Prentice Hall International

Books for Reference:

1. Everitt, B.S & Dunn, G (2001): Applied multivariate Data analysis, second edition, Arnold publishers, London.

2. Morrison, D.F (1990): A multivariate statistical methods, Third edition, Mc graw hall, New delhi.

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DATA MINING TECHNIQUES

BVDS502

Unit- 1: Data warehouse – definition – operational database systems Vs data warehouses – multidimensional model – from tables and spreadsheets to Data Cubes – schemas for multidimensional databases – measures – concept hierarchies – OLAP operations in the multidimensional data model – data warehouse architecture.

Unit- 2: Data mining – introduction – definition - data mining functionalities – major issues in data mining - data preprocessing – data cleaning – data integration and transformation – data reduction – data discretization and concept hierarchy generation. 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.

Unit- 3: 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.

Unit- 4: 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. Graph mining - 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.

References

1. Jain Pei, Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, 3rd

Edition, Elsevier, ISBN: 9380931913.

2. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining & OLAP,

Computing Mcgraw-Hill, ISBN: 0070062722.

3. K.P. Soman, Shyam Diwakar and V. Ajay, Insight into Data mining Theory and Practice, 1st Edition, Prentice Hall of India, ISBN: 8120328973.

4. G. K. Gupta, Introduction to Data Mining with Case Studies, 3 rd Edition, PHILearning Pvt. Ltd, ISBN: 8120350022.

5. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining, 1st Edition, Pearson India, ISBN: 9332518653.

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DESIGN OF EXPERIMENTS

BVDS503

Unit-1: Linear estimation, estimability of parametric functions and BLUE Gauss- Markov theorem-Linear Hypothesis.

Unit- 2: Analysis of variance, one way and two way classification (with single observation per cell), Analysis of covariance with a single observation per cell.

Unit- 3: Principles of design-randomization-replication-local control, completely randomized design; Randomized block design; Latin square design. Missing plot technique; comparison of efficiency; Greco-Latin square design (Concept only).

Unit- 4: Basic concepts of factorial experiments, 22 and 23 factorial experiments, Duncan‟s multiple range test. Incomplete block design; incidence matrix; orthogonal design (Definition only), Balanced incomplete bock design (Basic concept only), partially incomplete block design (Basic concept only).

Books for references

1. S.C. Gupta and V K Kapoor, Fundamentals of applied Statistics, Sulthan Chand and Sons

2. Federer, Experimental Designs

3. M N Das and N Giri, Design of Experiments, New Age international,

4. DD Joshy, linear Estimation and Design of Experiments, Wiley Eastern

5. Montgomeri, Design of Experiments

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SEMESTER-VI

CATEGORICAL DATA ANALYSIS

BVDS601

Unit- 1: Categorical Response data – Inference procedures. Contingency tables – Comparison of proportions, partial association in 2 x 2 and I x J tables. Testing independence in two-way contingency tables. Generalized Linear Model – For binary data & count data. Inference for & Fitting of GLMs.

Unit-2: Logistic Regression Model – Fitting & diagnostics. Conditional associations in 2 x 2 x K tables. Multinomial logit models – Baseline logit models for nominal responses & Cumulative logit model for ordinal responses.

Unit- 3: Loglinear models for two-way tables; Loglinear models for Independence & Interaction in three-way tables. Loglinear - Logit model connection. Diagnostics for checking models. Ordinal Association Models. Probit Models.

Unit- 4: Comparison of dependent proportions. Conditional logistic regression for Binary Matched pairs. Marginal models for square contingency tables. Symmetry, Quasi-Symmetry & Quasi independence.

Book for Study:

1. Alan Agresti (2002): Categorical Data Analysis. John Wiley & Sons

Book for Reference:

1. Hosmer, D.W. & Lemeshow, S. (1989)Applied Logistic Regression (John Wiley).

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STOCHASTIC MODELING

BVDS602

Objective: To introduce the vital area of regression models applicable in a wide variety of situations. To expose the students to the wide areas of its applications.

Unit- 1: Introduction to Regression – Mathematical and Statistical Equation – Meaning of Intercept and Slope – Error term – Measure for Model Fit –R2 – MAE – MAPE – Testing Significance of Model Coefficients, Confidence interval for model coefficients. Model diagnostics - Mean predicted value, Testing normality of error term, QQ-plot, PP-plot, Anderson Darling, Kolmogrov Smirnov

Unit- 2: Introduction to Multiple Linear Regression Model, Partial Regression Coefficients, Testing Significance overall significance of Overall fit of the model, Testing for Individual Regression Coefficients, Estimating R2, MAE and MAPE

Unit- 3: Dummy Variable trap, Study of Interaction Effects, Varying Intercept and Slope using dummy variable, Detection and Removal of Outliers. Study of Normality of Error Term using graphical and testing procedures, Testing for Multicollinearity using VIF, Testing for assumption of Homoscedasticity.

Unit- 4: Components of Time Series, Mathematical models of time series. Measurement of Trend Component : Graphic, Semi-Averages, Moving Averages. Least-squares – Straight Line, Second Degree Parabola, Exponential Curve, Modified Exponential Curve, Gompertz Curve, Logistic Curve. Measurement of Seasonal Variations – Simple averages, Ratio-totrend, Ratio-to Moving average, Link Relative. Deseasonalisation of data.Measurement of

Cyclic variations.

Books for Study:

1. Gujarati, D.(2004): Introduction to Econometrics. McGraw Hill, New Delhi.

Books for Reference:

1. Montgomery, D.C. ,Peck E.A, & Vining G.G.(2003). Introduction to Linear Regression

Analysis. John Wiley and Sons,Inc.NY Page

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MACHINE LEARNING AND DATA ANALYTICS

BVDS603

Unit-1: Introduction: Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation. Supervised Learning techniques: Introduction to machine learning ,Supervised Learning concepts, Linear Regression, Logistic regression, K-NN classification, Naïve Bayesian classifiers, SVM - (Support Vector Machines)

Unit-2: Decision Tree Learning : Representing concepts as decision trees. Recursive induction of decision trees. Picking the best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity. Occam's razor. Overfitting, noisy data, and pruning.

Unit-3: Ensemble Techniques :Introduction to Ensemble learning, Different Ensemble Learning Techniques -Bagging, Boosting, Random Forests, Stacking, Featurization, model selection, block chain and tuning: Text Analytics, Feature extraction, Model Defects & Evaluation Metrics, Model selection and tuning, comparison of machine learning models

Unit-4: Recommendation Systems: Introduction to Recommendation Systems, Types of Recommendation techniques - Collaborative Filtering, Content based Filtering, Hybrid RS, Case Study, Performance measurement, Deep Learning Concepts: Introduction to Deep Learning Concepts, Fundamentals of neural networks, Introduction to Tensor flow and Keras as Deep Learning frameworks, Tensor Flow illustrative example, Introduction to CNN,

Evaluation of Deep Learning model

References:

1. Data Science and Machine Learning with Python - Hands On!/by Frank Kane

2. J. Han, Data mining: concepts and techniques/Jiawei Han Micheline Kamber, Jian

Pei:Morgan Kaufmann Pub., pp. 740, 2012.

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