

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY



CIRCULAR NO.SU/Sci.& Tech./MCA(Sci.)/74/2022

It is hereby inform to all concerned that, the syllabi prepared by the Ad-hoc Board in MCA (Science) & recommended by the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted the **syllabus of Second Year (IIIrd & IVth semester) Master of Computer Application [MCA(Science)] under the Faculty of Science & Technology** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

This is effective from the Academic Year 2021-22 and onwards.

All concerned are requested to note the contents of this circular and bring notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
Ref.No. SU/MCA(Sci.)/2022/6790-99
Date:-12.01.2022.

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[Signature]
**Deputy Registrar,
Academic Section.**

Copy forwarded with compliments to :-

- 1] **The Principal, concerned affiliated College,**
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
- 2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

- 1] The Director, Board of Examinations & Evaluation,
- 2] The Section Officer, [M.Sc. Unit] Examination Branch,
- 3] The Section officer, [Eligibility Unit],
- 4] The Programmer [Computer Unit-1] Examinations,
- 5] The Programmer [Computer Unit-2] Examinations,
- 6] The In-charge, [E-Suvidha Kendra],
- 7] The Public Relation Officer,
- 8] The Record Keeper.

**RULES AND REGULATIONS SPECIFIC TO
M.C.A. PROGRAMME
IN
SCIENCE**



**Dr. Babasaheb Ambedkar Marathwada University,
Aurangabad.
(With Effect from Academic Year 2020-21)**

SEMESTER-III							
Code	Course	Credit	No of Hrs/Sem	Exam Hrs	Internal Marks	External Marks	Total
MCAS313	Design and Analysis of Algorithms	03	45	03	20	80	100
MCAS314	AI	03	45	03	20	80	100
MCAS315	Web Technology	03	45	03	20	80	100
MCAS316	Exploratory Data Analysis	03	45	03	20	80	100
MCAS317	Software Project Management	03	45	03	20	80	100
MCAS318	Elective II*	03	45	03	20	80	100
MCAS357	Practical VII (Based on Design and Analysis of Algorithms)	02	60	02	--	50	50
MCAS358	Practical VIII (Based on Web Technology)	02	60	02	--	50	50
MCAS359	Practical IX (Based on Exploratory Data Analysis)	02	60	02	--	50	50
MCAS360	Service Course**	03	60	03	20	80	100

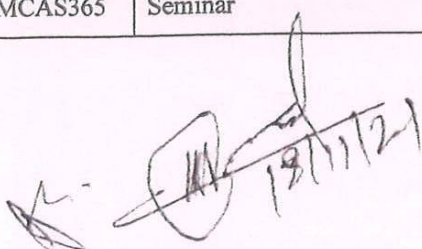
***Elective-II**

- MCAS318.1 Information Security
MCAS318.2 Internet of Things (IoT)
MCAS318.3 Deep Learning
MCAS318.4 Time Series Analysis and Forecasting Techniques
MCAS318.5 Natural Language Processing

****Service Course**

- MCAS360.1 Aptitude Development
MCAS360.2 Introduction to Matlab

SEMESTER-IV						
Code	Course	Credit	No of Hrs/week	Internal Marks	External Marks	Total
MCAS361	Dissertation Review-1	3	6	20	30	50
MCAS362	Dissertation Review-2	3	6	20	30	50
MCAS363	Dissertation Review-3	3	6	20	30	50
MCAS364	Final Dissertation	7	10	40	60	100
MCAS365	Seminar	5	4	10	40	50



SEMESTER-III

Design and Analysis of Algorithms (MCAS313)

Unit-1

Introduction: Algorithm, Psuedo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation, Probabilistic analysis, Amortized analysis.

Unit-2

Disjoint Sets- disjoint set operations, union and find algorithms, spanning trees, connected components and biconnected components.

Unit-3

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication.

Unit-4

Greedy method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

Unit-5

Dynamic Programming: General method, applications-Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, all pairs shortest path problem, Travelling sales person problem, Reliability design.

References:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Galgotia publications pvt. Ltd.
2. Design and Analysis Algorithms - Parag Himanshu Dave, Himanshu Bhalchandra Dave Publisher: Pearson.
3. Algorithm Design: Foundations, Analysis and Internet examples, M.T. Goodrich and R. Tomassia, John wiley and sons.

Lab Exercise:

Practical based on Design and Analysis of Algorithms: At least two experiments should be carried out on each unit.

Artificial Intelligence (MCAS314)

Prerequisites: To be admitted the student must have knowledge of Computing Science/ Cognitive Science, basic programming, Data Structures and Algorithms

Unit -1 Introduction to AI

Overview of A.I: Introduction to AI, Importance of AI, AI and its related field, Concept of AI, history, current status, scope, agents, environments, Problem Formulations, AI techniques, Criteria for success. Problems, problem space and search: Defining the problem as a state space search: Generate and test, hill climbing, best first search technique.

Unit –2 Knowledge Representation

Definition and importance of knowledge, Knowledge representation, various approaches used in knowledge representation, Issues in knowledge representation. Using Predicate Logic: Representing Simple Facts in logic, representing instances and is-a relationship, Computable function and predicate.

Unit –3 Natural language processing and Learning

Introduction syntactic processing, Semantic processing, Discourse and pragmatic processing. Learning: Introduction learning, Rote learning, learning by taking advice, learning in problem solving, learning from example-induction, Explanation based learning.

Unit-4 Planning

Classical planning and execution, STRIPS, Shakey. Reactive agents, Braitenberg vehicles, subsumption architecture. Potential fields architecture. The physical structure of robots. Teleoperation and semiautonomous robots.

Unit-5 Neural Networks

Networks: background and fundamentals. Artificial evolution, genetic algorithms short introduction. Multiple autonomous agents, swarm intelligence. Applications of AI Neural

Reference Books

1. Stuart Russell and Peter Norvig, —Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall
2. Elaine Rich and Kevin Knight, —Artificial Intelligence, Tata McGraw Hill
3. Trivedi, M.C., —A Classical Approach to Artificial Intelligence, Khanna Publishing House, Delhi. Robin Nixon
4. Saroj Kaushik, —Artificial Intelligence, Cengage Learning India, 2011
5. Artificial Intelligence: a modern approach, S. Russell and P. Norvig, Prentice Hall, ISBN0-13-080302-2
6. Qiangfu ZHAO and Tatsuo Higuchi, Artificial Intelligence: from fundamentals to intelligent searches, Kyoritsu, 2017, ISBN:978-4-320-12419-6 (in Japanese).
7. Introduction to Artificial Intelligence, Shinji Araya, KYORITSU SHUPPAN, ISBN4-320-12116-3 (in Japanese)
8. New Artificial Intelligence (Fundamental), Takashi Maeda and Fumio Aoki, Ohmsha, ISBN4-274-13179 (in Japanese)
9. New Artificial Intelligence (Advanced), Takashi Maeda and Fumio Aoki, Ohmsha, ISBN4-274-13198-X (in Japanese)
10. Web Link:
 1. <http://nptel.ac.in/syllabus/106105077/>
 2. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/syllabus/>
 3. <http://web.cs.iastate.edu/~cs572/syllabus.html>
 4. <http://www4.ncsu.edu/~stamant/411/syllabus.html>
 5. <http://web-ext.u-aizu.ac.jp/~qf-zhao/TEACHING/AI/AI.html>

Web Technology (MCAS315)

UNIT I

HTML & Forms: Overview of Internet, WWW, W3C, web publishing; Introduction To HTML, HTML Tags: changing background color of page, text color, text formatting tags, ordered and unordered lists tags, Inserting image, links: text, image links, image mapping, tables and HTML forms.

Introduction to XHTML: XML, Move to XHTML, Meta tags, Character entities, frames and frame sets, inside browser.

UNIT II

CSS: Introduction to style sheet, need for CSS, types of style sheets: inline, external, embedded CSS; syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2

JavaScript: Introduction to client side scripting, types, introduction to JavaScript, Java Script variables, functions, operators, control and looping structure, Javascript and objects, predefined Javascript objects, the DOM and web browser environments, forms and validations.

DHTML: Combining HTML, CSS and Javascript, events and buttons.

UNIT III

Server side programming – Web system architecture, uniform resource locator, introduction to HTTP, Web Server and Application Servers, installation of application servers, Config files, Web.xml, Java Servlet, servlet development process, deployment descriptors, generic servlet, lifecycle of servlet, servlet packages, classes, interfaces, and methods; handling forms with servlet, various methods of session handling, concept of cookies, handling of cookies, various elements of deployment descriptors, filters.

UNIT IV

JSP Basics: JSP lifecycle, directives, scripting elements, standard actions, implicit objects; Connection of JSP and servlet with different database.

Java Database Connectivity: various steps in process of connection to the database, various types of JDBC drivers - Querying a database, adding records, deleting records, modifying records, types of Statement.

UNIT V

Middleware Technologies - Separating business logic and presentation logic, building and using JavaBean, session handling in JSP, Types of errors and exceptions handling, MVC architecture, Introduction to Web Services; AJAX- Introduction, advantages & disadvantages, purpose, ajax based web application, alternatives of ajax.

Text Book(s)

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites", O'Reilly; 3rd edition, 2014.
2. Julie C. Meloni, "HTML, CSS and JavaScript All in One, Sams Teach Yourself: Covering HTML5, CSS3, and jQuery", Sams Publishing; 2nd edition, 2014.
3. Jendrock Eric, "The Java EE 7 Tutorial", volume 2, 5th edition, Addison-Wesley Professional, 2014.
4. Ivan Bayross, Sharanam Shah, Cynthia Bayross and Vaishali Shah, "J2EE for Professionals", First Edition, Shroff Publication, 2008.

Reference Books:

1. Steven Holzner, "HTML Black Book", Dreamtech press, 2000.
2. Ivan Bayross, "Web Enabled Commercial Application Development Using HTML, Javascript, DHTML and PHP", BpB Publications, 4th Edition 2010
3. Steven M. Schafer, "Web Standards Programmer's Reference: HTML, CSS, JavaScript, Perl, Python, and PHP", John Wiley & Sons, 2007.
4. Robert W. Sebesta, "Programming the world wide web", 8th Edition, Pearson Education, 2015.
5. Thomas Powell, "HTML & CSS: The Complete Reference", Fifth Edition, McGraw Hill Education, 2010.
6. Marty Hall, Larry Brown and Yaakov Chaikin, "Core Servlets and Java Server Pages: Advanced Technologies", 2nd edition, Prentice Hall, 2007.
7. Christian Bauer, Gavin King and Gary Gregory, "Java Persistence with Hibernate", 2nd Edition, Manning Publications, 2015

Lab Exercise:

Practical based on Web Technology: At least two experiments should be carried out on each unit.

Exploratory Data Analysis (MCAS316)**Unit-I: The Fundamentals of EDA**

Exploratory Data Analysis Fundamentals, the significance of EDA, making sense of data, Numerical data, Discrete data, Continuous data, Categorical data, Measurement scales, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA.

Line chart, Bar charts, Scatter plot, Bubble chart, Scatter plot using seaborn, Area plot and stacked plot, Pie chart, Table chart, Polar chart, Histogram, Lollipop chart, Choosing the best chart.

Unit-II: Data Transformation

Introduction, merging database-style data frames, concatenating along with an axis, merging on index, Reshaping and pivoting. Transformation techniques, performing data deduplication, replacing values, handling missing data, Renaming axis indexes, Discretization and binning, Outlier detection and filtering, String manipulation, Benefits of data transformation, Challenges.

Unit-III: Descriptive Statistics

Understanding statistics, Distribution function - Uniform distribution, Normal distribution, Exponential distribution, Binomial distribution. Cumulative distribution function, Descriptive statistics, measures of central tendency – Mean, Median, Mode. Measures of dispersion - Standard deviation, Variance, Skewness, Kurtosis, Calculating percentiles, Quartiles.

Unit-IV Grouping, Correlation and Time Series Analysis

Grouping Datasets - understanding groupby(), Groupby mechanics Data aggregation - Group-wise operations, Group-wise transformations. Correlation - Introducing correlation, Types of analysis - univariate analysis, bivariate analysis, multivariate analysis, discussing multivariate analysis using the Titanic dataset. Time Series Analysis- Understanding the time series dataset, Fundamentals of TSA, Univariate time series, Characteristics of time series data.

Unit-V Hypothesis Testing and Regression

Hypothesis testing, Hypothesis testing principle, statsmodels library, Average reading time, Types of hypothesis testing, T-test, p-hacking, Understanding regression, Types of regression. Model Development and Evaluation, EDA on Wine Quality Data Analysis.

Reference Book:

1. Suresh Kumar Mukhiya, Usman Ahmed "Hands-On Exploratory Data Analysis with Python", Packt Publishing – 2020.
2. Roger D. Peng "Exploratory Data Analysis with R".
3. John W. Tukey "Exploratory Data Analysis" Pearson Publication.
4. Allen B. Downey "Think Stats: Exploratory Data Analysis" 2nd Edition, O'reilly publication.

Lab Exercise:

Practical based on Exploratory Data Analysis: At least two experiments should be carried out on each unit.

Software Project Management (MCAS317)

Unit-1. Introduction

What is project? What is project Management, The role of project Manager, The project Management Profession, Project life cycle.

Unit-2. Technology Context

A system view of project management, Understanding organizations, Stakeholder management, Project phases and the project life cycle, The context of information technology projects.

Unit-3. Introduction

Developing the project schedule, Project management software tools, Developing the project budget, Finalizing the project schedule and budget, Monitoring and controlling the project, The project communications plan. Project metrics Reporting performance and progress, Information distribution.

Unit-4. The importance of project risk management

Risk management planning, Common sources of risk on information technology projects, Risk identification, Qualitative risk analysis, Quantitative risk analysis, Risk response planning, Risk monitoring and control, using software to assist in project risk management.

Unit-5. The importance of project procurement management

Planning purchase and acquisitions, planning contracting, requesting seller responses, selecting sellers, Administering the contract, Closing the contract, using software to assist in project management, Outsourcing. **Change management:** The nature of change, The change management plan, Dealing with resistance and conflict. **Leadership & Ethics in Projects:** Project leadership, Ethics in projects, Multicultural projects, **Introduction:** Project implementation, administrative closure, Project evaluation.

References:

1. Information Technology Project Management: Kathy Schwalbe Thomson Publication.
2. Information Technology Project Management providing measurable organizational value Jack Marchewka Wiley India.
3. Applied software project management Stellman & Greene SPD.
4. Software Engineering Project Management by Richard Thayer, Edward Yourdon WILEY INDIA.

Information Security (MCAS318.1)**Unit-1**

Introduction to Information Security: Attacks, Vulnerability, Security Goals, Security Services and mechanisms.

Unit-2

Conventional Cryptographic Techniques: Conventional substitution and transposition ciphers, One-time Pad, Block cipher and Stream Cipher, Steganography.

Unit-3

Symmetric and Asymmetric Cryptographic Techniques: DES, AES, RSA algorithms, Authentication and Digital Signatures: Use of Cryptography for authentication, Secure Hash function, Key management – Kerberos.

Unit-4

Program Security: Nonmalicious Program errors – Buffer overflow, incomplete mediation, Time-of-check to Time-of use Errors, Viruses, Trapdoors, Salami attack, Man-in-the middle attacks, Covert channels.

Unit-5

Security in Networks: Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP, S/MIME.

Reference Books:

1. Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education
2. Cryptography and Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson
3. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall.
4. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall.

Internet of Things (IoT) (MCAS318.2)

Unit I:

Introduction to IoT: Definition, Characteristics, Conceptual framework, Architectural view; Technology involved - Server-end technology, Hardware and Software components, Development tools & Open source framework, APIs & Device interfacing components, Platforms & Integration tools, Sources of IoT, Advantages and Disadvantages of IoT, IoT enabling technologies, IoT implementation challenges.

Unit II:

Domain specific IoTs: Introduction, home automation, cities, environment, energy, retail, logistics, agriculture, industry, health and lifestyle.

IoT and M2M: Introduction, machine-to-machine Communication, difference between IoT and M2M; SDN and NFV for IoT - Software Defined Networking, Network Function Virtualization.

Unit III:

Data Acquiring, Organizing and Processing: Introduction, data generation, data acquisition, data validation; Data categorization for storage, various types of data stores, organizing the data, transactions, business processes, integration; Online transactions and processing, stream processing, real-time processing, event stream processing, business process, business intelligence, distributed business process, enterprise systems, service oriented architecture(SOA).

Unit IV:

Data Analytics and Machine Learning for IoT: Analytics phases - descriptive, predictive, and prescriptive analytics; online analytical processing; Introduction to statistical and machine learning tools for data analytics; Introduction to Big data, Big data characteristics, Big data analytics.

Role of the cloud in IoT: Cloud Storage models and communication APIs for IoT.

Security in IoT: Security challenges for IoT, IoT security practices.

Unit V:

Introduction to Arduino Programming: Familiarizing with Arduino Interfacing Board, configuration and architecture, Arduino IDE installation, program structure, data types, variables and constants, operators, control statements and loops, functions, strings, time, arrays, function libraries: I/O functions, Character functions, Math library, Interrupts, Communications. Integration of Sensors and Actuators with Arduino.

TEXT BOOKS:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands-On Approach", Universities Press (India) Private Limited, First edition, 2015.
2. Mayur Rangir, "Internet of Things - Architecture, Implementation and Security", Pearson India Education Services Pvt. Ltd. First edition, 2020.
3. Raj Kamal, "Internet of Things: Architecture and Design Principles", McGraw Hill Education, India, First Edition, 2017.
4. Simon Monk, "Programming Arduino™: Getting Started with Sketches", McGraw Hill Publication, 2012.

REFERENCES:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press Inc., 2014.

2. Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, 2014.
3. Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann, "Interconnecting Smart Objects with IP: The Next Internet", Morgan Kaufmann Publishers, 2010.
4. Michael Miller, "The Internet of Things - How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", Pearson Education Inc., 2015.
6. Tom Igoe, "Making Things Talk Using Sensors, Networks, and Arduino to see, hear, and feel your world", Make Community, LLC; 3rd edition. 2017.
7. Richard Blum, "Arduino Programming in 24 Hours", Pearson Education; 1st edition, 2015.
8. Arduino Tutorial available at : <https://www.tutorialspoint.com/arduino/index.htm>

Deep Learning (MCAS318.3)

Unit-I: Introduction to Neural Network

Introduction, Biological neural network, The Basic Architecture of Neural Network: single-layer and multi-layer networks, Chain Rule, Training a Neural Network with Backpropagation Networks, Stochastic Gradient Descent, Computational Challenges, Neural Networks in Artificial Intelligence.

Unit-II: Deep Neural Networks

Deep learning: Introduction, Applications, Workflow of training and evaluating deep learning model, Preventing Overfitting: Regularization, Dropout, Activation Functions, Learning Rate, Vanishing and Exploding Gradients, Hyperparameter optimization, Building Deep Neural Network.

Unit-III: Convolutional Neural Networks

Convolutional network architectures, Filters, Feature Maps, Pooling, Batch Normalization, Complete Convolutional Network for images, Case Study: LeNet, AlexNet6.

Unit-IV: Recurrent Neural Networks:

Sequences of Unequal Length, Learning with Recurrent Neural Networks, Adding Feedback Loops and Unfolding, Building Recurrent Neural Network, Case Study: Long Short-Term Memory, Gated Recurrent Unit.

Unit-V GENERATIVE DEEP LEARNING

Text generation with LSTM, The importance of the sampling strategy, Implementing character-level LSTM text generation, DeepDream, Implementing Deep Dream in Keras.

Text Books:

1. Charu Agrawal, Neural Networks and Deep Learning, Springer International Publishing AG, 2018
2. Nikhil Budua, Fundamentals of Deep Learning, Designing Next Generation Artificial Intelligence Algorithms, First edition, O'Reilly Publications, 2016.
3. Skansi, Sandroi, Introduction to Deep Learning from Logical Calculus to Artificial Intelligence, Springer International Publishing AG, 2018

Reference Books:

1. Introduction to Artificial Neural Systems by Jacek M. Zurada Yegnanarayana B, Artificial Neural Systems, PHP learning
2. Goodfellow, Y. Bengio, A. Courville, Deep Learning (MIT press, Cambridge, 2016).
3. A. Gulli, S. Pal, Deep Learning with Keras (Packt publishing, Birmingham, 2017)

4. Michael A. Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015
5. François Chollet, "Deep Learning with Python"

Time Series Analysis and Forecasting Techniques (MCAS318.4)

Unit-1

Univariate methods, setting the stage, Simple smoothing methods, Decomposition method, Holt's and Winters' smoothing methods.

Unit-2

Regression Methods, review simple regression, RMSE and Coefficient of Determination, Introduction to Multiple Regression, Statistical Inference in Multiple Regression, Comparative Analysis Using Regression.

Unit-3

Variable Selection in Multiple Regression, Model Selection in Regression, Checking Regression Models, Autocorrelation in Regression.

Unit-4

Box-Jenkins Methods, Introduction to Time Series Modelling, ARMA Models, Identification of ARMA models, ARIMA Models, ARIMA Models Identification, Building better models from ARIMA

Unit-5

Parameter Estimation and Diagnostic checking, Forecast using ARIMA models, Modelling Seasonal Data, Intervention Analysis.

Reference:

1. "Forecasting and Time Series", 4th Edition, by Bowerman and O'Connell, Duxbury

Natural Language Processing (MCAS318.5)

Prerequisites:

- 1) To have basic knowledge of AI
- 2) To have basic understanding of English Grammar

Unit 1 Introduction:

Introduction to NLP, Brief History, Applications: Speech to text, story understanding, QA system, Machine Translation, Text summarization, text classification, sentiment analysis, chatterbox, challenges/Open Problems, Natural Language (NL) Characteristics and NL computing techniques, NL tasks: Segmentation, Chunking, tagging, NER, Parsing, Word Sense Disambiguation, NL Generation.

Unit 2 Web 2.0 Applications:

Sentiment Analysis, Text Entailment, Cross Lingual Information Retrieval (CLIR). ML basics, algorithms, Naïve Bayes, Bayesian Statistics, HMM, CRF

Unit 3 Word Forms, POS tagging and Chunking: Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology;

References:

1. www.mathworks.com (MATLAB Toolbox)
2. "Understanding MATLAB" by Shroff Publications, 2013, Authors: K V Kale, R R Manza, V T Humbe, P L Yannawar and G. R. Manza, Shroff Publications

Service Course on Aptitude Development (MCAS362.1)**Unit 1 General Intelligence –I**

Analogy, Series Completion, Coding-Decoding, Blood Relations, Classification.

Unit 2 General Intelligence –II

Venn diagram and Sets Tests, Matrix Text, Puzzle Test, Number Ranking and Time Sequence Test, Arithmetical Reasoning.

Unit 3 General Intelligence –III

Sequential output Tracing, Direction ability Test, Mathematical Operations, Logical Sequence of Words, and Decision Making

Unit 4 Logic Reasoning

Logic, Statement-Arguments, Statement-Assumptions, Statement –Courses of Action, Statement Conclusions, Deriving Conclusions from Passages.

Unit 5 Non Verbal Reasoning

Analytical Reasoning, Mirror Images, Water Images, Embedded Figures, Cubes and Dice.

References:

- Quantitative abilities by Arun Sharma
- Quantitative Aptitude for Competitive Examinations by R S Agrawal
- Verbal and Non-Verbal reasoning by R S Agrawal