MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI
PG - COURSES – AFFILIATED COLLEGES
COURSE STRUCTURE FOR MASTER OF COMPUTER APPLICATIONS (MCA)

(Choice Based Credit System)

(With effect from the academic year 2020-21 onwards)

III	15	Core – 14	Data Analytics using R	4	4
	16	Core – 15	Digital Image Processing	4	4
	17	Core – 16	Principles of Compiler Design	4	4
	18	Core – 17	Research Methodology	4	4
	19	Elective – 2 (Select any one)	Internet of Things/ Software Project Management/ Mobile Communications/ Cyber Security	4	3
	20	Core - 18 Practical - 3	Data Analytics using R Lab	4	2
	21	Core - 19 Practical - 4	Mini Project	4	6
IV	22	Core – 20	Major Project	36	16

DATA ANALYTICS USING R

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UNIT – I INTRODUCTION TO DATA SCIENCE

Introduction: Introduction of Data Science-Getting started with R- Exploratory Data Analysis- Review of probability and probability distributions- Bayes Rule Supervised Learning- Regression Polynomial regression- Local regression- k-nearest neighbors **(12L)**

UNIT – II UNSUPERVISED LEARNING

Unsupervised Learning- Kernel density estimation k-means- Naive Bayes- Data and Data Scraping Classification-ranking- logistic regression. Ethics- time series advanced regression-   Decision   trees-   Best   practices   feature   selection. **(12L)**

UNIT – III BIG DATA FROM DIFFERENT PERSPECTIVES

Big data from business Perspective: Introduction of big data-Characteristics of big data-Data in the warehouse and data in Hadoop- Importance of Big data- Big data Use cases: Patterns for Big data deployment. Big data from Technology Perspective: History of Hadoop Components of Hadoop-Application Development in Hadoop-Getting your data in Hadoop-other Hadoop Component. **(12L)**

UNIT – IV INFOSPHERE BIGINSIGHTS

Infosphere Big Insights: Analytics for Big data at rest-A Hadoop-Ready Enterprise-Quality file system-Compression –Administrative tooling-Security Enterprise Integration – Improved workload scheduling-Adaptive map reduce-Data discovery and visualization-Machine   Analytics

(12L)

UNIT – V INFOSPHERE STREAMS

Infosphere Streams: Analytics for Big data in motion Infosphere Streams Basics working of Infosphere Streams-Stream processing language-Operators-Stream toolkits-Enterprise class

(12L)

TOTAL : 60 PERIODS

REFERENCES

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data Hardcover , EMC Education Services, Wiley Publication, 2015
2. Big Data with HadoopMapReduce: A Classroom Approach 1st Edition by RathinarajaJeyaraj , Ganeshkumar Pugalendhi ,Anand Paul, Apple Academic Press, 2020
3. The Data Science Handbook Hardcover – Illustrated by Field Cady, 2017.

DIGITAL IMAGE PROCESSING

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UNIT - I

Fundamentals - The MATLAB Desktop - Using Mat lab Editor /Debugger getting help-saving and Retrieving work session data - Digital Image Representation - Image I/O and Display – Classes and Image Types - M-Function Programming.

Intensity Transformation and Spatial Filtering: Background - Intensity transformation - Histogram Processing and function Plotting - Spatial filtering - Image processing toolbox standard spatial filters. **(12L)**

UNIT - II

The 2-D Discrete Fourier transform - Computing and Visualizing the 2-D DFT in MATLAB – Filtering in the Frequency domain - Obtaining frequency domain filters from spatial filters - High pass (sharpening) frequency domain filters.

Image Restoration and Reconstruction: A model of the image degradation / restoration process - Noise models - Restoration in the presence of Noise only – Periodic Noise reduction using Frequency Domain Filtering – Modeling the Degradation Function - Direct Inverse Filtering - Wiener filtering. **(12L)**

UNIT - III

Color image representation in MATLAB - converting to other color spaces - The basics of color image processing - Color transformation - Spatial Filtering of colour images. Working directly in a RGB vector space.

Wavelets: Background - The fast wavelet transform -Working with wavelet decomposition structures - The inverse wavelet transform- Wavelets in image processing.

(12L)

UNIT - IV

Image Compression: Background - Coding Redundancy - Spatial Redundancy - Irrelevant information- JPEG Compression.

Morphological Image Processing: Preliminaries - Dilation and Erosion - Combining Dilation and Erosion - Labeling connected components **(12L)**

UNIT - V

Image Segmentation: Point, line and edge detection - Line detection using the Hough transform – Thresholding – Region - Based segmentation using the Watershed transform.

Representation and Description: Background – Representation - Boundary Descriptors.
(12L)

TOTAL DURATION: 60 PERIOD

Reference Books:

1. Rafael C.Gonzalez, Richard E.Woods, Steven L.Eddins, "Digital Image Processing Using MATLAB", Third Edition, Tata McGraw Hill Private Limited, New Delhi, 2011.
2. Anil.K.Jain, "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
3. S.Jayaraman, S.Essakirajan&T.Veerakumar, "Digital Image Processing"|, Second Edition, McGraw Hill, 2020.
4. Rafael C.Gonzalez, Richard E. Woods, "Digital Image Processing", Fourth Edition, Pearson Education, 2018.

PRINCIPLES OF COMPILER DESIGN

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UNIT I

Introduction to Compiler: Language Processors – The Structure of Compiler – The Science of Building a Compiler – Application of Compiler Technology - Programming Language Basics.

A Simple Syntax – Directed Translator: Syntax Definition – Syntax Directed Translation – Parsing – A Translator of Simple Expression – Lexical Analysis – Symbol Table – Intermediate Code Generation. **(12L)**

UNIT II

Lexical Analysis: The Role of the Lexical Analyzer – Input Buffering – Specification of Tokens– Recognition of Tokens – The Lexical – Analyzer Generator Lex – Finite Automata – From Regular Expression to Automata – Design of a Lexical-Analyzer Generator – Optimization of DFA – Based Pattern Matchers. **(12L)**

UNIT III

Syntax Analysis: Introduction – Context-Free Grammars – Writing a Grammar – Top-Down Parsing – Bottom-Up Parsing – Introduction to LR Parsing: Simple LR – More Powerful LR Parsers – Using Ambiguous Grammars – The Parser Generator Yacc**(12L)**

UNIT IV

Syntax Directed Translation: Syntax-Directed Definitions – Evaluation Orders for SDD's – Applications of Syntax Directed Translation – Syntax Directed Translation Schemes

Intermediate-Code Generation: Variants of Syntax Trees – Three – Address Code – Types and Declarations – Translations of Expressions – Type Checking – Control Flow – Back patching – Switch Statements – Intermediate Code for Procedures **(12L)**

UNIT V

Run-Time Environments: Storage Organization – Stack Allocation of Space – Access to Nonlocal Data on the Stack.

Code Generation: Issues in the Design of a Code Generator – The Target Language – Address in the Target Code – Basic Blocks and Flow Graph. **(12L)**

TOTAL DURATION: 60 PERIOD

Reference Books:

1. Alfred V.Aho, Monica S. Lam, Ravi Sethi, Jeffrey D.Ullman, "Compilers –Principles, Techniques and Tools", Pearson Education Asia, Second Edition, 2014
2. Terence Halsey, Compiler Design Principles, Techniques and Tools, Larsen and Keller Education, 2018
3. Dick Grune, Kees van Reeuwijk, Henri E.BalCeriel J.H Jacobs, Koen Langendoen : Modern Compiler Design, Second Edition, Springer 2012.
4. Douglas Thain " Introduction to Compilers and Language Design" University of Notre Dame, 2019

RESEARCH METHODOLOGY

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UNIT I

Introduction - Meaning of Research – Objectives of Research – Types of Research – Motivation of Research – Research approaches – Significance of Research – Research Methods versus Methodology – Research and Scientific method – Research process – Criteria of good Research – Problems encountered by Researchers in India.

Defining the Research Problem: What is a Research problem - Selecting the Problem – Technique involved Defining a problem.

Research Design: Meaning – Need for Research Design – Features of Good Design – Important concept relating to Research design – Different Research designs – Basic Principles of Experimental Designs **(12L)**

UNIT II

Sampling Design : Census and Sample Survey – Implications of a sample design – Steps in sample design - Criteria of selecting a sampling procedure – Characteristics of a good sample design – Different types of sample design – How to select a random sample – Random sample from an infinite Universe – Complex random sampling designs.

Measurements and Scaling techniques : Measurement in Research – Measurement scales – Sources of error in Measurement – Test and sound Measurements – Technique of developing measurement tools – Scaling, Meaning of scaling – Scale classification bases – Important scaling techniques – Scale Construction techniques. **(12L***)*

UNIT III

Chi-Square Test for large samples – Definition of Chi-Square – Limitations of Chi-Square test - Chi-Square test as a test of goodness of fit and as a test of independence – Yate's correction and its applications.

Analysis of Variance (ANOVA): Concept – One way ANOVA – ANOVA in test in Latin Square Design **(12L)**

UNIT IV

Data Collection: Methods of Data Collection – Collection of Primary Data – Observation Method – Interview method – Collection of data through Questionnaires – Collection of data through Schedules – Some other methods of data collection – Collection of secondary data – Selection of appropriate method for data collection.

Interpretation and Report Writing: Meaning of interpretation – Why interpretation – Technique of interpretation – Precaution in Interpretation – Significance of Report Writing

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UNIT – V

Introduction – Algorithmic Research Problems – Types of Solution Procedure/ Algorithm – Steps of Development of Algorithm – Steps of Algorithmic research – Design of Experiments and Comparison of Algorithms – Meta Heuristics for Combinational Problems. The Computer – Its role in Research – The Computer and Computer Technology – The Computer System – Important Characteristics - Computer Applications – Computer and Researchers.

(12L)

TOTAL : 60 PERIODS

Reference Books:

1. C.R.Kothari, "Research Methodology Methods and Techniques", Second edition, New Age International Publishers, 2020.
2. R.Panneerselvam, "Research Methodology", PHI, 2009.
3. S.C Gupta and V.K Kapoor, "Fundamentals of Mathematical statistics", Sulthan Chand & Sons, Delhi, 2020.
4. Deepak Chawla and NeenaSondhi," Research Methodology: Concepts and Cases",Vikas Publishing House, 2016.
5. David M.Levine, David F Stephen,e al., "Business Statistics", Pearson Publisher, 7th edition,2017.
6. Ranjit Kumar "Research Methodology: A Step-by-step Guide for Beginners", Sage Publications Ltd, 2019.

INTERNET OF THINGS

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4 0 0 3

UNIT I FUNDAMENTALS OF IOT

What is IOT-Genesis of IoT-IoT and Digitization – IoT Impact - Convergence of IT and OT - IoT Challenges - **IoT Network Architecture and Design:** Drivers Behind New Network Architectures – The oneM2M IoT Standardized Architecture - The IoT World Forum (IoTWF) Standardized Architecture - A Simplified IoT Architecture - The Core IoT Functional Stack - IoT Data Management and Compute Stack. **(9L)**

UNIT II SMART OBJECTS AND CONNECTING SMART OBJECTS

The "Things" in IoT: Sensors, Actuators, and Smart Objects - Sensor Networks - Communications Criteria - IoT Access Technologies: IEEE 802.15.4, IEEE 802.15.4g and 802.15.4e, IEEE 1901.2a, IEEE 802.11ah, LoRaWAN, NB-IoT and Other LTE Variations.

(9L)

UNIT III IP AS THE IOT NETWORK LAYER AND APPLICATION PROTOCOLS FOR IOT

The Business Case for IP – The Need for Optimization – Optimizing IP for IoT - Profiles and Compliances - **Application Protocols for IoT:**The Transport Layer, IoT Application Transport Methods –   SCADA: A Little Background on SCADA - Adapting SCADA for IP - Tunneling Legacy SCADA over IP Networks - SCADA Protocol Translation - Generic Web-Based Protocols - IoT Application Layer Protocols – CoAP - Message Queuing Telemetry Transport (MQTT)**(9L)**

UNIT IV DATA AND ANALYTICS FOR IOT AND SECURING IOT

An Introduction to Data Analytics for IoT - Machine Learning - Big Data Analytics Tools and Technology: Massively Parallel Processing and NoSQL Databases, Hadoop, YARN,The Hadoop Ecosystem, Apache Kafka, Lambda Architecture - Edge Streaming Analytics - Network Analytics - **Securing IoT :** A Brief History of OT Security - Common Challenges in OT Security - How IT and OT Security Practices and Systems Vary - Formal Risk Analysis Structures: OCTAVE and FAIR **(9L)**

MSU /2020-21/P.G. Colleges/MCA /Semester –III / Ppr.No.19/ Elective – 2 (a)

UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS

Smart and Connected Cities: An IoT Strategy for Smarter Cities, Smart City IoT Architecture , Smart City Security Architecture , Smart City Use-Case Examples– **Transportation:** Transportation Challenges, IoT Use Cases for Transportation, An IoT Architecture for Transportation, Connected Roadways Network Architecture,*Connected Roadways Security* , Extending the Roadways IoT Architecture to Bus Mass Transit **Mining:** Mining Today and Its Challenges, Challenges for IoT in Modern Mining, An IoT Strategy for Mining **Public Safety :** Overview of Public Safety, An IoT Blueprint for Public Safety, Emergency Response IoT Architecture, IoT Public Safety Information Processing, School   Bus   Safety.
(9L)

TOTAL DURATION: 45 PERIOD

Reference Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017
2. Hassan Q.F, Atta UR Rehman Khan " Internet of Things: Challenges Advances and Applications", T & F India Publisher, 2019
3. ShriramK.Vasudevan " Internet of Things" Wiley Publication, 2020
4. ArshdeepBahga, Vijay Madisetti, "Internet of Things –A hands-on approach", Universities Press, 2015
5. Olivier Hersent, David Boswarthick, Omar Elloumi "The Internet of Things –Key applications an d Protocols" Wiley, 2012.

SOFTWARE PROJECT MANAGEMENT

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UNIT I PROJECT EVALUATION AND PROJECT PLANNING

Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning. **(9L)**

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION

Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model. **(9L)**

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules. **(9L)**

UNIT IV PROJECT MANAGEMENT AND CONTROL

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management. **(9L)**

UNIT V   STAFFING IN SOFTWARE PROJECTS

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

(9L)

TOTAL : 45 PERIODS

REFERENCES:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Sixth Edition, Tata McGraw Hill, New Delhi, 2017.
2. Robert K. Wysocki ―Effective Software Project Management – Wiley Publication, 2019.
3. Walker Royce: ―Software Project Management: A Unified Frame work- Addison-Wesley, 2013.
4. Gopalaswamy Ramesh, ―Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013.

MOBILE COMMUNICATIONS

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4 0 0 3

UNIT I

Introduction: Applications and need for wireless network. **Wireless transmission**: signals - Antennas - Signal propagation. **Wireless Switching Technology:** Multiplexing - Modulation - Spread spectrum - Cellular systems. **(9L)**

UNIT II

Medium Access Control: Motivation for a Specialized MAC - SDMA - FDMA - TDMA- CDMA- Comparison. **Telecommunication System:** GSM, DECT, TETRA. **Satellite System**: History - Applications - Basics - Routing - Localization - Handover. **(9L)**

UNIT III

Wireless LAN: Infrared vs radio transmission - Infrastructure and ad-hoc network - IEEE 802.11 - HIPERLAN - Bluetooth. **(9L)**

UNIT IV

Mobile network layer: Mobile IP - Dynamic host configuration protocol - Mobile ad-hoc networks. **Mobile Transport Layer:** Traditional TCP - Classical TCP Improvements - TCP over 2.5/3G wireless networks. **(9L)**

UNIT V

Support for Mobility: File Systems - World Wide Web- Wireless Application Protocol - i-mode - SyncML - WAP 2.0 **(9L)**

TOTAL : 45 PERIODS

Reference Books:

1. UpenaDalal , Manoj.K.Shukula " Wireless and Mobile Communication" Oxford University Press, 2016
2. Yoshihiko Akaiwa "Introduction to Digital Mobile Communication" Second Edition, Wiley Publication, 2015
3. JochenSchier, "Mobile Communications", Second Edition, Pearson Education, 2007.

CYBER SECURITY

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4 0 0 4

UNIT 1: INTRODUCTION TO CYBER SECURITY

Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace. **(9L)**

UNIT 2: CYBER SECURITY VULNERABILITIES AND CYBER SECURITY SAFEGUARDS

Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management. **(9L)**

UNIT 3: INTRUSION DETECTION AND PREVENTION

Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation. **(9L)**

UNIT 4: CRYPTOGRAPHY AND NETWORK SECURITY

Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec. **(9L)**

UNIT 5: CYBERSPACE AND THE LAW

Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013. **(9L)**

TOTAL DURATION: 45 PERIOD

Reference Books:

1. "Cryptography and Network Security - Principles and Practice", William Stallings, Pearson Education, Seventh Edition 2017.
2. Cyber Security Paperback, Prof. Amit Grag, Dr.Krishan Kumar Goyal, First edition, 2019.
3. Cyber Security Paperback, Nina Godbole, Sunit Belapure,Wiley, 2011.
4. Cyber security for Dummies Paperback, Joseph Steinberg, 2020.
5. "Information and Cyber Security", Gupta Sarika, Khanna Publishing House, Delhi, 2019

DATA ANALYTICS USING R LAB

1. R program to create a Sequence of numbers from 20 to 50 and find the Mean of numbers from 20 to 60 and Sum of numbers from 51 to 91.

2. R program to create a Vector which contains 10 random integer values between -50 and +50.

3. R program to get all Prime numbers up to a given number.

4. R program to read the .csv, .xls files and display the contents.

5. R program to use Built-in Mathematical Functions.

6. R program to get the Statistical Summary and Nature of the data of a given data frame.

7. Find the Data Distributions using Box and Scatter Plot using R.

8. Plot the Histogram, Bar Chart and Pie Chart on sample data using R.

9. Plot the Density and the Cumulative Probability Curve for a Normal Distribution with Mean= 2.5 and SD = 1.5 using R.

10. Build the Correlation Matrix using R.

11. Build a Decision Tree Classifier using R.

12. Build a Naïve Bayes Classifier using R.

Mini Project

Project