

**BIKANER TECHNICAL UNIVERSITY, BIKANER**



**PROGRAMME SCHEME & SYLLABUS**

**Mater of Computer Application**

**SECOND YEAR**

## Semester III

Course Code	Course Title	Type of Paper	Contact Hours Per Week	Exam Hrs	Internal Assessment	End Term Exam	Total	Credits
MCA 321	Mobile Application Development	Theory	03	03	20	80	100	03
MCA 322	Information Security	Theory	03	03	20	80	100	03
MCA 323	Data Science	Theory	03	03	20	80	100	03
MCA - 324	Internet of Things	Theory	03	03	20	80	100	03
	Elective-I	Theory	03	03	20	80	100	03
	Elective-II	Theory	03	03	20	80	100	03
MCA 325	Mobile Application Development Lab	Practical	04	03	60	40	100	02
MCA326	Information Security Lab	Practical	04	03	60	40	100	02
MCA327	Data Science Lab	Practical	04	03	60	40	100	02
<b>Total Credits for III Semester</b>							<b>900</b>	<b>24</b>

**Mandatory Summer Training: 45 working days summer Training during semester Break between (III & IV semester), of 100 marks. Evaluation will be done in semester-IV examinations.** Summer training can be carried out in any MNC, Voluntary organization, NGO, MSME, Public sector Units, society, and cooperative etc. on any research project dealing in IT and its related domain.

### Elective- I

Sr. No.	Course Code	Course Name
1	MCAE331A	Computer Vision
2	MCAE332A	Natural Language Processing
3	MCAE333A	Soft Computing

### Elective - II

Sr. No.	Course Code	Course Name
1	MCAE341B	Deep Learning
2	MCAE342B	Web Intelligence and Big Data
3.	MCAE343B	Software Quality Management

## Semester IV

Course Code	Course Title	Type of Paper	Contact Hours Per Week	Exam Hrs	Internal Assessment	End Term Exam	Total	Credits
MCA 421	Artificial Intelligence & Machine Learning	Theory	03	03	20	80	100	03
MCA 422	Ethical Hacking	Theory	03	03	20	80	100	03
MCA 423	Industrial Project	Practical	12	3	100	200	300	09
MCA 424	Summer Industrial Training Presentation	Practical	02	-	20	80	100	02
<b>Total Credits for IV Semester</b>							<b>600</b>	<b>16</b>
<b>Total Credits for MCA</b>							<b>90</b>	

Note: The industrial project is part of the curriculum will be held in the institute as one of the laboratories/Incubation Center. This may be in continuations to the project under taken by the student during industrial training and/or of industrial nature and/or have good industrial significance and/or may be done in collaboration with industry (as per suitability at the institute level). The evaluation will be done in the institute by one internal examiner and one external examiner (from outside the institute) appointed by BTU.

1. Industrial Project shall be related to his/her subjects of MCA or to any other functional area. An internal mentor/guide shall be appointed for each student. It is mandatory for the student to seek advance written approval from the internal mentor and Head of Department about the topic and organization before commencing the Industrial/Field Training. Internal mentor/guide needs to take regular update during the period to evaluate the actual working of the student. Maximum two students can work on a single project.

2. The students need to submit the report within 2 weeks' time after completion of Industrial/Field Project period. And this report will be evaluated via internal and external Viva-Voce.

5. The work may be based on primary / secondary data or may be an operational assignment involving working by the student on a given task/assignment/project/ etc. in Summer Training.

### **Dissertation**

The project report should contain the following:

- Original copy of the Approved Performa and Project Proposal.
- Certificate of Originality (Format given).
- Project documentation.
- A CD consisting of the executable file(s) of the complete project should be attached on the last page of the project report. In no case, it should be sent separately. The student needs to retain the identical copy of the CD that should be carried while appearing for the viva-voce along with the project report.

### **Project Documentation:**

- Project documentation may be about 100 to 125 pages (excluding coding).
- The project documentation details should not be too generic in nature.

- Appropriate project report documentation should be done, like, how you have done the analysis, design, coding, use of testing techniques/strategies, etc., in respect of your project.
- The project report should normally be printed with single line spacing on A4 paper (one side only). All the pages, tables and figures must be numbered. Tables and figures should contain titles.
- Two copies of the original project report in the bound form along with the CD (containing the executable file(s) of the project should be enclosed in the last page) is to be prepared at the time of final viva. One copy of the same Project Report and the CD containing the executable file(s) shall be retained by the student, which should be produced before the examiner at the time of viva-voce

**MANUAL FOR PREPARATION OF MCA Project (Prescribed Format and Specification)**

**Essential Components of Project Report**

- Title Page
- Certificate from Company
- Certificate from Guide
- Acknowledgement
- Index with printed Page Numbers

**CHAPTER 1 : INTRODUCTION**

- 1.1 Company/Educational Institute Profile
- 1.2 Existing System and Need for System
- 1.3 Scope of Work
- 1.4 Operating Environment – Hardware and Software

**CHAPTER 2: PROPOSED SYSTEM**

- 2.1 Proposed System
- 2.2 Objectives of System
- 2.3 User Requirements

**CHAPTER 3: ANALYSIS & DESIGN**

- 3.1 Entity Relationship Diagram (ERD)
- 3.2 System Architecture
- 3.3 Database Requirements & User Interfaces
- 3.4 Data Flow Diagram (DFD)
- 3.5 Data Dictionary
- 3.6 Table Design
- 3.7 Code Design
- 3.6 Menu Screens
- 3.7 Input Screens
- 3.8 Report Formats
- 3.9 Test Procedures and Implementation

**CHAPTER 4: User Manual**

- 4.1 User Manual
- 4.2 Operations Manual / Menu Explanation
- 4.3 Forms and Report Specifications

Drawbacks and Limitations

Proposed Enhancements

Conclusions

Bibliography

**Annexure:**

- Annexure 1: Input Forms with data
- Annexure 2: Output Reports with Data
- Annexure 3: Sample Code

**Course Code: MCA 321**  
**Course Title: Mobile Application Development**

Unit	Contents
<b>I</b>	<b>INTRODUCTION:</b> Introduction to mobile applications – Market and business drivers for mobile applications – Difficulties in Mobile Development- Mobile Myths- When to Create an App– Types of Mobile App. Design Constraints for mobile applications, both and software related, Architecting mobile applications, user interfaces for mobile applications, touch events and gestures.
<b>II</b>	<b>ADVANCED DESIGN:</b> Designing applications with multimedia and web access capabilities Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications – Understanding Application users, Information Design, Achieving quality constraints.
<b>III</b>	<b>TECHNOLOGY I ANDROID:</b> Establishing the development environment Android architecture Android Application Structure, Emulator- Android virtual device, UI design, Fragments, Activity, Services, broadcast receiver, Intents/Filters, Content provider-SQLite Programming, SQLITE open, Helper, SQLite Database, Interaction with server-side application, Recent Advancement
<b>IV</b>	<b>Advanced Android:</b> Using Google Maps, GPS and Wi-Fi Integration, Android Notification, Audio Manager, Bluetooth, Camera and Sensor Integration, Sending SMS, Phone Calls, Publishing Android Application
<b>V</b>	<b>TECHNOLOGY II IOS:</b> Introduction to Objective C iOS features UI implementation Touch frameworks Data persistence using Core Data and SQLite, Action and Outlets, Delegates and Storyboard, Location aware applications using Core Location and Map Kit, Integrating calendar and address book with social media application Using Wifi iPhone marketplace.
<p><b>Text Books:</b></p> <ul style="list-style-type: none"> <li>• Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012</li> <li>• Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012</li> </ul> <p><b>Reference Books:</b></p> <ul style="list-style-type: none"> <li>• David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.</li> <li>• James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012</li> <li>• Paul Deitel, Harvey Deitel, Abbey Deitel and Michel Morgano, "Android for Programmers an App-Driven Approach", Pearson, 2012</li> <li>• Neil Smyth "Android studio 2.2 Development Essentials 7th Edition" Payload Media 2017</li> <li>• Jerome Dimarzio "Beginning Android Programming with Android Studio" Wiley Publication</li> </ul>	

**Course Code: MCAE 344B**  
**Course Title: Information Security**

Unit	Contents
<b>I</b>	<b>Introduction to Information Security:</b> Definition, Availability, Confidentiality, Accuracy, Integrity and Authenticity. <b>Security Threats:</b> Vulnerabilities, Threats, Attacks and Countermeasures, Secure Software Development.
<b>II</b>	<b>Ethical Issues in Information Security:</b> Law and Ethics in Information Security, International Law and Legal bodies, Ethics and Information Security, Codes of Ethics. <b>Managing IT Risk:</b> Introduction, Risk Management, Risk Identification, Risk Assessment, Risk Control Strategies, Risk Control Strategy, Quantitative and Qualitative Risk Control.
<b>III</b>	<b>Security Plan:</b> Concept, Information Security Planning and Governance, Policies, Standards, Practices, Information Security with ISO, NIST Models, Security Education, Training and Awareness. <b>Security Technologies:</b> Access Control: Identification, Authentication, Authorization and Accountability.
<b>IV</b>	<b>Firewalls:</b> Processing modes, Structure, Architecture, Configuring, Remote User Connections, Access and Authentication. <b>Security Technology: Prevention System, Intrusion Detection:</b> Intrusion Detection and Prevention System, Operating System Fundamentals and Security Tools, Biometrics Access Controls.
<b>V</b>	<b>Implementing Information Security:</b> Remote Computing Security, Security Project Management, Technical Aspects of Implementation, Information Security Certifications. <b>Maintenance:</b> Security Management Maintenance Models, Vulnerability Assessment, Introduction to Digital Forensics
<p><b>Text Books:</b></p> <ul style="list-style-type: none"> <li>• Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, CENGAGE Learning, 4th Edition, 2003.</li> <li>• Mark Merkow, James Breithaupt, “Information Security: Principles and Practices”, Pearson Education, 1st Edition, 2007.</li> <li>• Micki Krause, Harold F. Tipton, “Information Security Management Handbook, CRC Press LLC, 6th Edition, 2004.</li> </ul> <p><b>References:</b></p> <ul style="list-style-type: none"> <li>• Mark Rhodes, Ousley, “Information Security - The Complete Reference”, McGraw Hill Education, 2nd Edition, 2013.</li> <li>• Matt Bishop, “Computer Security Art and Science”, Pearson Education, 2nd Edition, 2002.</li> <li>• Charles P. Pfleeger and Shari Lawrence Pfleeger, “Security in Computing”, PHI, 4th Edition, 2006.</li> <li>• William Stallings, “Cryptography and Network Security: Principles and Practices”, Pearson Education, 4th Edition, 2005.</li> <li>• Roberta Brag, Mark Rhodes-Ousley, “Network Security - The complete Reference”, McGraw Hill Education, 2nd Edition, 2017.</li> </ul>	

**Course Code: MCA 323**  
**Course Title: Data Science**

Unit	Contents
<b>I</b>	<b>Introduction</b> What is Data Science, Need for Data Science, Components of Data Science, Big data, Facets of data: Structured data, Unstructured data, Natural Language, Machine-generated data, Graph-based or network data, Audio, image and video, Streaming data, The need for Business Analytics, Data Science Life Cycle, Applications of data science
<b>II</b>	<b>Introduction to Big Data</b> Classification of Digital Data, Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Classification of Analytics, Top Challenges Facing Big Data, Responsibilities of data scientists, Big data applications in healthcare, medicine, advertising
<b>III</b>	<b>Data Science Process</b> Overview of data science process, setting the research goal, retrieving data, Cleansing, integrating and transforming data, Exploratory data analysis, Data Modeling, Presentation and automation, Types of Analytics: Descriptive analytics, Diagnostic analytics, Predictive analytics, Prescriptive analytics
<b>IV</b>	<b>Statistics</b> Basic terminologies, Population, Sample, Parameter, Estimate, Estimator, Sampling distribution, Standard Error, Properties of Good Estimator, Measures of Centers, Measures of Spread, Probability, Normal Distribution, Binary Distribution, Hypothesis Testing ,Chi-Square Test , ANOVA
<b>V</b>	<b>Data Science Tools and Algorithms</b> Basic Data Science languages- R, Python, Knowledge of Excel, SQL Database, Introduction to Weka, Regression Algorithms: How Regression Algorithm Work, Linear Regression, Logistic Regression, K-Nearest Neighbors Algorithm, K-means algorithm.

**Text Books:**

- Samuel Burns, “Fundamentals of Data Science: Take the first Step to Become a Data Scientist” , Amazon KDP Printing and Publishing, First Edition, 2019
- Davy Cielen, Arno D.B. Meysman, Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016

**References:**

- Cathy O’Neil and Rachel Schutt, “Doing Data Science, Straight Talk From The Frontline”, O’Reilly. 2014.

**Course Code: MCA 324**  
**Course Title: Internet of Thing**

Unit	Contents
<b>I</b>	<p><b>The Internet of Things:</b> An Overview of Internet of things, Characteristics, History and Evolution of IoT, Physical Design of IoT: Things in IoT, IoT Protocols. Internet of Things Technology, behind IoTs Sources of the IoTs,  <b>Logical Design of IoT:</b> Functional block, Communication Models and APIs, IoT Stack.</p>
<b>II</b>	<p><b>Enabling Technologies:</b> Sensors, Cloud Computing, Big Data analytics, Embedded Computing Boards, Communication Protocols, IoT Challenges, IoT Levels, Overview of Domain Specific IoTs applications Like Smart Cities, Smart Agriculture and Industrial IoT Applications.  <b>The IoT Paradigm:</b> Comparison with User interface related Technologies like SCADA, M2M, SDN. IoT Design Methodology: IoT Components.</p>
<b>III</b>	<p><b>Internet Vs Internet of Things:</b> IoT Layers, IoT Messaging Protocols: MQTT, CoAP. IoT Transport Protocols: BLE, LiFi, Network Protocol: 6LoWPAN.  <b>Physical Design of IoT:</b> Functional Block, Cloud Storage Models, Communication Models, and Communication APIs: REST based, Web Socket Based, Cloud for IoT: Challenges, Fog Computing.</p>
<b>IV</b>	<p><b>Physical Devices and Endpoints:</b> Arduino Pin diagram, Arduino Architecture, Arduino Programming, Raspberry Pi Pin diagram, Raspberry Pi Architecture.  <b>Sensors and Interfacing:</b> Types of Sensors. <b>Integrating Sensors:</b> HDT (Humidity and Temperature Sensor), Gas Detector, HC-05 (Bluetooth Module), Ultrasonic Sensor, ESP8266 (Wi-Fi Module).</p>
<b>V</b>	<p><b>Logical Design of IoT:</b> Revisiting Python Programming for IoT (Data types, Operators, Control Structures, List, Tuples, Dictionaries, Functions, Modules and File Handling).  <b>Python Packages for connecting IoT Devices:</b> Bluetooth, Sockets, Time, Requests, Sys, Adafruit Python DHT, paho-mqtt, Python JSON, Python pip</p>
<p><b>Text Books:</b></p> <ul style="list-style-type: none"> <li>• S. K. Vasudevan, A. S. Nagarajan, RMD Sundaram, “Internet of Things”, Wiley, 1st Edition, 2014.</li> <li>• G. C. Hillar, “Internet of Things with Python”, PACKT Publications, 1st Edition, 2016.</li> <li>• V. Madiseti, A. Bahga, “Internet of Things: A Hands-on Approach”, United Kingdom: ArsheepBahga&amp; Vijay Madiseti, 1st Edition, 2015.</li> </ul> <p><b>References:</b></p> <ul style="list-style-type: none"> <li>• J. C. Shovic, “Raspberry Pi IoT Projects: Prototyping Experiments for Makers”, Apress, 1st Edition, 2016.</li> <li>• M. Schwartz, “Internet of things with the Arduino Yun”, Packt Publishing Ltd., 1st Edition, 2014.</li> <li>• Hersent, D. Boswarthick, O. Elloumi, “The Internet of Things: Key Applications and Protocols”, John Wiley &amp; Sons, 1st Edition, 2012.</li> <li>• C. Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus”, Wiley Publishing, 1st Edition, 2013.</li> </ul>	

**Course Code: MCA324**  
**Course Title: Mobile Application Development Lab**

<b>Contents</b>
Survey of Mobile Application Development Tools. Form design for mobile applications. Applications using controls. Graphical and Multimedia applications. Data retrieval applications. Networking applications. Gaming applications Micro browser-based applications Application explaining the Basic UI Design with all the relevant Fields A Simple application illustrating styles and themes. Call Log Notification Menu. GUI Application. Creating live Folders with search options. A simple database application. A simple offline search Engine.
<b>Text Books:</b> <ul style="list-style-type: none"><li>• Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012</li><li>• Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012</li></ul>
<b>Reference Books:</b> <ul style="list-style-type: none"><li>• David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.</li><li>• James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012</li><li>• Paul Deitel, Harvey Deitel, Abbey Deitel and Michel Morgano, "Android for Programmers an App-Driven Approach", Pearson, 2012</li><li>• Neil Smyth "Android studio 2.2 Development Essentials 7th Edition" Payload Media 2017</li><li>• Jerome Dimarzio "Beginning Android Programming with Android Studio" Wiley Publication</li></ul>

**Course Code: MCA325**  
**Course Title: Information Security Lab**

<b>Contents</b>
<p>Implement encryption, decryption using the following substitution techniques:</p> <ul style="list-style-type: none"><li>a) Ceaser cipher</li><li>b) Playfair cipher</li><li>c) Hill Cipher</li><li>d) Vigenere cipher</li></ul> <p>Perform encryption and decryption using following transposition techniques: Rail fence - Row &amp; Column Transformation</p> <p>Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).</p> <p>Implement the following Attack:</p> <ul style="list-style-type: none"><li>a) Dictionary Attack</li><li>b) Brute Force Attack</li></ul> <p>Installation of Wire shark, TCP dump etc. and observe data transferred in client server communication using UDP/TCP and identify the UDP/TCP datagram.</p> <p>Installation of rootkits and study about the variety of options.</p> <p>Demonstrate intrusion detection system using any tool (snort or any other s/w).</p> <p>Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures.</p> <p>Detect ARP spoofing using open-source tool ARPWATCH.</p> <p>Implement a code to simulate buffer overflow attack.</p> <p>To study the steps to create a LAN, WAN and VPN in a simulator (GNS3 or any other similar simulator)</p>
<p><b>Text Books:</b></p> <ul style="list-style-type: none"><li>• Computer Networks 5th By Andrew S. Tanenbaum (International Economy Edition) by Andrew S. Tanenbaum David J. Wetherall</li><li>• Cryptography and Network Security - Principles and Practice   Seventh Edition   By Pearson by Stallings William (Author) Michael E Whitman and Herbert J Mattord, "Principles of Information Security", CENGAGE Learning, 4th Edition, 2003.</li><li>• Mark Merkow, James Breithaupt, "Information Security: Principles and Practices", Pearson Education, 1st Edition, 2007.</li><li>• Micki Krause, Harold F. Tipton, "Information Security Management Handbook, CRC Press LLC, 6th Edition, 2004.</li></ul> <p><b>References:</b></p> <ul style="list-style-type: none"><li>• Mark Rhodes, Ousley, "Information Security - The Complete Reference", McGraw Hill Education, 2nd Edition, 2013.</li><li>• Matt Bishop, "Computer Security Art and Science", Pearson Education, 2nd Edition, 2002.</li><li>• Charles P. Pfleeger and Shari Lawrence Pfleeger, "Security in Computing", PHI, 4th Edition, 2006.</li><li>• William Stallings, "Cryptography and Network Security: Principles and Practices", Pearson Education, 4th Edition, 2005.</li><li>• Roberta Brag, Mark Rhodes-Ousley, "Network Security - The complete Reference", McGraw Hill Education, 2nd Edition, 2017.</li></ul>

**Course Code: MCA 326**  
**Course Title: Data Science Lab**

<b>Contents</b>
General Properties of R Language Decision Making Loop control Array Vector Matrices Factors Data Frames Packages Data Reshaping Data and File Management Charts & Graphs Graphical Procedures plot function Plot using base graphics Plot using ggplot2
<b>Text Books:</b> <ul style="list-style-type: none"><li>• Sandip Rakshit, R Programming for Beginners, Tata McGraw Hill Publishing Company Limited.</li><li>• Introduction to Machine Learning with Python: A Guide for Data Scientists — By Andreas C. Müller and Sarah Guido.</li><li>• Niel J le Roux, Sugnet Lubbe, A step by step tutorial: An introduction into R application and programming, Bookboon Learning</li><li>• Python Data Science Handbook by Jake Vander Plas</li></ul>
<b>References:</b> <ul style="list-style-type: none"><li>• Hadley Wickham and Garrett Golemund, "R for Data Science" O'Reilly</li><li>• Automate the Boring Stuff with Python: Practical Programming— by Al Sweigart.</li></ul>

**Course Code: MCAL 333A**  
**Course Title: Computer Vision**

Unit	Contents
<b>I</b>	<p><b>Introduction</b>  Machine vision systems, optics and lenses, image sensors, human vision and Neuro-visual model; Marr’s paradigm; Imaging geometry – world co-ordinate system and camera co-ordinate system, co-ordinate transformations, projection geometry, camera calibration, radiometry. Early processing and image filtering: Noise removal, region segmentation, concept of primal sketch, scale space, edge detection and localization, edge linking,, Hough transform, corner and junction detection.</p>
<b>II</b>	<p><b>Reflectance map and photometric stereo:</b> Image brightness and radiometry, image formation and surface reflectance under different conditions, reflectance map and bidirectional reflectance distribution function, photometric stereo recovering albedo and surface orientation, shape from shading.</p> <p><b>Range measurement and recovering scene geometry:</b>Binocular technique – stereo pair, epipolar line and plane, Stereo matching, photogrammetry, monocular technique – texture processing and shape from texture, depth from focusing and symmetry, different range finder (active) – laser range finder, light-stripe method.</p>
<b>III</b>	<p><b>Motion estimation:</b> Motion field, optical flow – smoothness, boundary conditions, discontinuities of optical flow, block based method, pre-recursive method, Bayesian method, motion segmentation method, motion from points and lines, token tracking, stereo and motion tracking, use of Kalman filter, focus of expansion, structure from motion, motion compensated filtering and restoration, video compression, active and passive surveillance.</p>
<b>IV</b>	<p><b>Representation and analysis of polyhedral scene:</b>Understanding line drawings, gradient and dual space, generalized cylinder, volumetric representation, edge and junction labelling; Labelling and recognition of scene objects; Construction of model-base and visual learning, model based recognition system – Acronym, model based recognition from sparse range data, 3D model based vision system, scene understanding.</p>
<b>V</b>	<p><b>Special systems for computer vision:</b>Visual information processing architecture, language and control, Some applications (but not restricted to): (i) Automated guided vehicle, (ii) Face and gesture recognition, (iii) Vision based inspection system, (iv) Grasping system, (v) Automated visual inspection.</p>
<p><b>Text Books:</b></p> <ul style="list-style-type: none"> <li>• D. H. Ballard and C. M. Brown: Computer Vision, Prentice Hall, New York, 1986.</li> <li>• R. M. Haralick, L. G. Shapiro: Computer and Robot Vision, Addison-Wesley Pub Co, reading, Mass., 1992.</li> <li>• Y. Shirai: Three-Dimensional Computer Vision, Springer-Verlag, Berlin, 1988.</li> <li>• B. K. P. Horn: Robot Vision, MIT Press, Cambridge, 1986.</li> <li>• O. Faugeras: Three-Dimensional Computer Vision: A Geometric Viewpoint, MIT Press, Cambridge, 1993.</li> </ul> <p><b>References:</b></p> <ul style="list-style-type: none"> <li>• B. K. P. Horn and M. J. Brooks: Shape from Shading, M.I.T. Press, Cambridge, 1989.</li> <li>• R. Jain, R. kasturi and B. Schuck: Machine Vision, McGraw Hill Higher Education, New York, 1995.</li> <li>• E. R. Davis: Machine Vision: Theory, Algorithms and Practicalities, Academic Press, New York, 1996.</li> <li>• M. Sonka, V. Hlavac and R. Boyle, Image Processing: Analysis and Machine Vision, PWS Pub. Co., London, 1998.</li> </ul>	

**Course Code: MCAL 333A**  
**Course Title: Natural Language Processing**

Unit	Contents
<b>I</b>	<b>Introduction</b> Origins and challenges of NLP – Language Modelling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.
<b>II</b>	<b>Word Level Analysis:</b> Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformationbased tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.
<b>III</b>	<b>Syntactic Analysis:</b> Context-Free Grammars, Grammar rules for English, Treebank’s, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures
<b>IV</b>	<b>Semantics And Pragmatics:</b> Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods
<b>V</b>	<b>Discourse Analysis And Lexical Resources:</b> Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Co reference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill’s Tagger, WorldNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC)
<b>Text Books:</b> <ul style="list-style-type: none"> <li>• Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014</li> <li>• Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, O’Reilly Media, 2009</li> </ul> <b>References:</b> <ul style="list-style-type: none"> <li>• Breck Baldwin, —Language processing with Java and Ling Pipe Cookbook, Atlantic Publisher,2015</li> <li>• Richard M Reese, —Natural Language Processing with Java, O’Reilly Media, 2015</li> <li>• Nitin Indurkha and Fred J. Damerau, —Handbook of Natural Language Processing, Second, Chapman and Hall/CRC Press, 2010</li> <li>• Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008</li> </ul>	

**Course Code: MCAE 334A**  
**Course Title: Soft Computing**

Unit	Contents
<b>I</b>	<b>Introduction to Soft Computing</b> Introduction of Hard and Soft Computing, Unique features of Soft computing, Components of Soft computing, Fuzzy Computing, Evolutionary Computation, Genetic Algorithm, Swarm Intelligence, Ant Colony Optimizations, Neural Network, Machine Learning , Associative Memory, Adaptive Resonance Theory, Introduction to Deep Learning.
<b>II</b>	<b>Neural Networks</b> Introduction and Architecture: Neuron, Nerve structure and synapse, Artificial Neuron and its model, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Back propagation networks architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, back propagation algorithm, applications.
<b>III</b>	<b>Fuzzy Logic</b> Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion, Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzy fications & Defuzzy ficataions, Fuzzy Inference Systems, Mamdani Fuzzy Model, Sugeno Fuzzy Model, Fuzzy Controller, applications.
<b>IV</b>	<b>Genetic Algorithms</b> Traditional optimization and search techniques, Genetic Algorithms: Basic concepts of GA, working principle, procedures of GA, Process flow of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.
<b>V</b>	<b>Hybrid Systems</b> Integration of neural networks, fuzzy logic and genetic algorithms. GA Based Back Propagation Networks, Fuzzy Back Propagation Networks, Fuzzy Associative Memories, Simplified Fuzzy ARTMAP.
<b>Text Books:</b> <ul style="list-style-type: none"> <li>• S. Rajasekaran and G.A.VijaylakshmiPai.. Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India 2007.</li> <li>• K.H.Lee.. First Course on Fuzzy Theory and Applications, Springer-Verlag.</li> <li>• D. K. Pratihar, Soft Computing, Narosa, 2008.</li> <li>• J.-S. R. Jang, C.-T. Sun, and E. Mizutani, Neuro-Fuzzy and soft Computing, PHI Learning, 2009.</li> </ul> <b>References:</b> <ul style="list-style-type: none"> <li>• J. Yen and R. Langari.. Fuzzy Logic, Intelligence, Control and Information, Pearson Education.</li> <li>• N.P.Padhy, "Artificial Intelligence and Intelligent Systems" Oxford University Press.</li> <li>• Melanie Mitchell, An Introduction to Genetic Algorithms, MIT Press, 2000.</li> <li>• Simon Haykin, Neural Networks and Learning Machines, (3rd Edn.), PHI Learning, 2011.</li> </ul>	

**Course Code: MCAE 341B**  
**Course Title: Deep Learning**

Unit	Contents
<b>I</b>	Introduction to Deep Learning (DL), Applications of deep Learning, Limitations of deep learning algorithms, Artificial vs Biological Neurons, how do they learn? Perceptron, introduction to Artificial Neural Network (ANN), Deep Neural Network, Transfer learning, Introduction to Feature Extraction vs Fine Tuning.
<b>II</b>	Deep Learning Tools - Python - Numpy, Pandas, Scikit-learn etc, Framework for deep learning algorithm - TensorFlow, Keras, Google Colab etc, Popular Data repositories sources for machine learning practices (UCI, Kaggle, Wikipedia, Google Dataset Search), Working with Google Colab: Uploading data, Creating Data Generators, Working with OS Module, creating Val Dir, Training using 'fit_generator', Visualizing Results.
<b>III</b>	Neural Networks - output vs hidden layers, Linear vs Nonlinear Networks, Activation Functions: Sigmoid, ReLU, Softmax. Loss function, Perceptron Training Rule, Multilayer Perceptron, Gradient Descent Rule. Gradient Descent and Backpropagation: Gradient Descent, Stochastic Gradient Descent, Backpropagation - recursive chain rule,
<b>IV</b>	Introduction to Convolutional Neural Networks: Kernel filter, Principles behind CNNs, Multiple Filters, CNN applications. Padding, Data Augmentation, Introduction to Recurrent Neural Networks: Introduction to RNNs, LSTM, RNN applications.
<b>V</b>	Optimization and Regularization: Overfitting and Capacity, Cross Validation, Feature Selection, Regularization, Hyperparameters, dropout, batch normalization. Early stopping of training, Deep Learning Applications: Image Processing, Natural Language Processing, Speech Recognition, Video Analytics, Transfer Learning. Project Task - End-to-End Deep learning Model Development – Cat Vs Dog Classification,
<p><b>Text Books:</b></p> <ul style="list-style-type: none"> <li>• Ian Goodfellow, Deep Learning, Second edition, MIT Press, 2016.</li> <li>• Nicholas Locascio, Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms, O'Reilly, 2017.</li> </ul> <p><b>References:</b></p> <ul style="list-style-type: none"> <li>• Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, , Cambridge University Press, 2012.</li> <li>• Aurelien Geron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, O'Reilly, 2017.</li> </ul>	

**Course Code: MCAE 342B**  
**Course Title: Web Intelligence and Big Data**

Unit	Contents
<b>I</b>	<b>Introduction Web Intelligence:</b> Characteristics of the Web, Web structure, Retrieval vs. browsing, The long tail in Social networks. What is Web Intelligence, Benefit of Web Intelligence, Ingredients of Web Intelligence, Related Technology and Application. <b>Information Retrieval:</b> Document representation, Stemming, Term-Document Matrix, Standard Document collections.
<b>II</b>	<b>Retrieval Model:</b> Boolean retrieval Model, Vector space retrieval model, probabilistic information Model <b>Evaluation Criteria:</b> Precision and Recall, Confusion Matrix <b>Architecture of a Web Search Engine:</b> The crawler. Indexing systems, queries and ranking. Scalability. Ranking through link analysis.
<b>III</b>	<b>Multimedia Search:</b> images, audio and video <b>Image and Short Text Mining:</b> Text Pre-processing: Data Cleaning, Data Integration, Data Transformation, Segmentation <b>Image Pre-Processing:</b> Image histogram analysis, Noise cleaning, Segmentation <b>Classification Algorithms:</b> Linear Regression, Decision Tree, K-means, Naive Bayes
<b>IV</b>	<b>Understanding Big Data:</b> What is Big Data? Why Big Data? Big Data Applications, Big Data Analytics, Big Data Challenges. <b>Introduction to NoSQL:</b> Aggregate Data Models, Key-Value and Document Data Models, Graph Databases, Schema Less Databases, Big Data Solutions.
<b>V</b>	<b>Introduction to Hadoop:</b> Hadoop architecture, Hadoop Working, Advantages of Hadoop, HDFS Overview, Features of HDFS, HDFS Architecture <b>Map reduce applications:</b> Map Reduce workflows, Hadoop streaming, Components of Hadoop Ecosystem (HBase, Sqoop, Flume, PigLatin scripts. Hive), Apache Spark
<b>Text Books:</b> <ul style="list-style-type: none"> <li>• Rajendra Akerkar, Pawan Lingras, “Building an Intelligent Web: Theory and Practice”Front Cover Jones &amp; Bartlett Learning, 2010.</li> <li>• Data Science and Big Data Analytics, Discovering, Analyzing, Visualizing andPresenting Data, Wiley</li> <li>• Nathan Marz, James Warren, “Big Data: Principles and Best Practices of Scalable RealTime Data Systems”, Manning, 2015</li> <li>• Dirk De Roos, Melnyk, Bruce Brown, RaefelCoss, “Hadoop For Dummies”, John Wiley&amp; Sons, 1st Edition, 2014.</li> <li>• <b>References:</b></li> <li>• Zhong, Zhongying, Liu, Jiming, Yao, Yiyu (Eds.), “Web intelligence”, Springer, 1<sup>st</sup>Edition, 2003</li> <li>• DT Editorial Services, “Big Data Black Book”, Dreamtech Press, 2015.</li> </ul>	

**Course Code: MCAE 343B**  
**Course Title: Software Quality Management**

Unit	Contents
<b>I</b>	<b>Fundamentals of Software Quality:</b> Define Software Quality, Software Quality Assurance Context, Challenges of Software Quality, Environments for SQA, Relate Software Quality and the Software Development Life Cycle, Software Quality Assurance versus Software Quality Control
<b>II</b>	<b>Software Quality Assurance:</b> Components of Software Quality Assurance System, Software Requirements into Software Quality Factors, Product Operation, Revision and Transition Software Quality Factors, Alternative Models of Software Quality Factors, SQA Tools
<b>III</b>	<b>Tailoring the Software Quality Assurance System:</b> The SQA Architecture, Pre-Project Components (Contract Review, Quality Plans), Software project life cycle components (Review, Audit planning and implementation, Testing), infrastructure and management components, Organizing SQA, Guidelines for SQA construction <b>Participants in Software Quality Management:</b> Understand SQA management organization, Describe management roles, organization, and activities.
<b>IV</b>	<b>ASE Tools in Software Quality:</b> Overview of CASE Tool, Contribution of CASE Tool to Software Product, Software Maintenance and Software Project Quality <b>Software Quality Metrics:</b> Classification, Process Metrics, Product Metrics, Implementation and Limitations.
<b>V</b>	<b>SQA Standards:</b> Scope of Quality Standards, Six Sigma, Overview of ISO, CMMI, IEEE standards with examples <b>Costs of Software Quality:</b> Cost of Software Quality Metrics, Classic and extended model of cost of software quality, Application and Problems. <b>Future of Software Quality:</b> SQA Challenges and Capabilities
<b>Text Books:</b> <ul style="list-style-type: none"> <li>• Daniel Galin, “Software Quality Assurance: From Theory to Implementation”, Addison Wesley, 1st Edition, 2003.</li> <li>• Stephen Kan, “Metrics and Models in Software Quality Engineering”, Addison Wesley, 2nd Edition, 2002.</li> <li>• Claude Y. Laporte, Alain April, “Software Quality Assurance”, Wiley, 1st Edition, 2017.</li> </ul> <b>References:</b> <ul style="list-style-type: none"> <li>• Schulmeyer, G. Gordon and McManus, James, (eds), “Handbook of Software Quality Assurance”, Prentice Hall, 3rd Edition, 1999.</li> <li>• Boehm, B., Huang, L., Jain, A., and Madachy, R. "The ROI of Software Dependability: The iDAVE Model", Software, IEEE(21:3) 2004, pp 54-61</li> <li>• Kshirasagar Naik, Priyadarshi Tripathy, “Software Testing and Quality Assurance Theory and Practice,” Wiley, 1st Edition, 2008.</li> </ul>	

**Course Code: MCA 421**  
**Course Title: Artificial Intelligence and Machine learning**

Unit	Contents
I	<b>INTRODUCTION:</b> Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Processing.
II	<b>INTRODUCTION TO SEARCH:</b> Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning.
III	<b>KNOWLEDGE REPRESENTATION &amp; REASONING:</b> Approaches to knowledge representation: Propositional Logic, First Order Predicate Logic, Inference Rules (Modus Ponens, Modus Tollens, Resolution, And elimination, Syllogism), Production Rules, Types of knowledge, Reasoning: Forward and backward reasoning, Non-monotonic Reasoning, Reasoning with uncertainties.
IV	<b>MACHINE LEARNING:</b> Machine Learning basics, Why Machine learning, Types of Machine Learning Problems, Applications of ML, Data Mining Vs Machine Learning vs Big Data Analytics. <b>Supervised Learning-</b> Naïve Base Classifier, classifying with k-Nearest Neighbour classifier, Decision Tree classifier, Naive Bayes classifier.
V	<b>UNSUPERVISED LEARNING</b> -Dimensionality reduction (Principal component analysis), K-means clustering, Ensemble Learning (Boosting and Bagging). Neural Networks, Types of Neural networks, Activation functions, Feed forward, Back Propagation Algorithm, Recommender Systems, Content based recommendations.

**Text Books:**

- Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed., 2009
- Stuart Russell, Peter Norving, “Artificial Intelligence: A Modern Approach”, Pearson Education, 3<sup>rd</sup> edition, 2010.
- Ethem Alpaydın, Introduction to Machine Learning, PHI, Third Edition.
- Tom Mitchell, Machine Learning, McGraw-Hill, First Edition,

**Reference Books:**

- Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Prentice Hall of India, 1<sup>st</sup> edition, 1997.
- Winston, Patrick, Henry, “Artificial Intelligence”, Pearson Education, 3<sup>rd</sup> edition, 2004
- Daniel Jurafsky, James H. Martin Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
- Winston, LISP, Addison Wesley
- Marcellous, Expert System Programming, PHI
- Shai Shalev-Shwartz and Shai Ben David, Understanding Machine Learning From Theory to Algorithms, Cambridge University Press, First Edition.
- Christopher M. Bishop, Pattern Recognition and Machine Learning, McGraw Hill,
- Elamie, Artificial Intelligence, Academic Press
- Lioyed, Foundation of Logic Processing, Springer Verlag
- Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, First Edition, O'Reilly Media, 2009.

**Course Code: MCA 422**  
**Course Title: Ethical Hacking**

Unit	Contents
<b>I</b>	<b>Introduction to ethical Hacking:</b> What is ethical hacking? Types of hacking, advantages, disadvantages and purpose of hacking, Types of hackers, Code of ethics, Types of attacks and attack vector types, Prevention from hackers, The Indian IT Act 2000 and Amendments to the Indian IT Act(2008) ,Phases of hacking. Footprinting and Reconnaissance. What is footprinting? Active and passive footprinting, purpose of footprinting , objectives of footprinting, footprinting threats, Types of footprinting, footprinting countermeasures.
<b>II</b>	Scanning networks, Enumeration and sniffing: Scanning networks: Network scanning and its types, objectives of network scanning, scanning live systems, scanning techniques-TCP Connect / Full Open Scan, Types of Stealth scans, port scanning countermeasures, IDS evasion techniques, Banner grabbing and its tools, vulnerability scanning, proxy servers, anonymizers, IP spoofing and its countermeasures.
<b>III</b>	Enumeration and Sniffing: What is Enumeration? Enumeration techniques, Enumeration types, Enumeration countermeasures, what is sniffing? Wire trapping and its types, packet sniffing, sniffing threats, how sniffers work, sniffing methods-ARP spoofing and MAC flooding, active and passive sniffing, types of sniffing attacks, sniffing countermeasures, sniffing detection techniques.
<b>IV</b>	Trojans and other Attacks: Worms, viruses, Trojans, Types of worms, viruses and worms, Preventing malware attacks, types of attacks: (DoS /DDoS), Waterhole attack, brute force, phishing and fake WAP, Eavesdropping, Man-in-the-middle, buffer overflow, DNS poisoning, ARP poisoning, Identity Theft, IoT Attacks, BOTs and BOTNETs, Steganography - text, image and audio and video, types of Social Engineering: Physical social engineering, Remote social engineering and hybrid social engineering.
<b>V</b>	Hacking web servers, web applications and SQL injection: Session hijacking: session hijacking, session hijacking techniques, session hijacking process, Types of session hijacking,session hijacking countermeasures: protecting and preventing, Hacking web servers and web applications: Causes of webservers being compromised, web server attacks, stages of web server attacks, web application threats and counter measures. SQL Injection, SQL injection threats, SQL injection attacks, SQL injection detection, SQL injection methodology, SQL injection prevention and countermeasures.

**Text Books:**

- Ankit Fadia, Ethical Hacking, Second Edition, Macmillan India Ltd, 2006
- Kevin Beaver, Hacking for Dummies, Fifth Edition, Wiley, 2016
- CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.
- Kenneth C.Brancik, Insider Computer Fraud, Auerbach Publications Taylor & Francis Group, 2008.
- Patrick Engebretson, The Basics of Hacking and Penetration Testing, Second Edition, Syngress, 2013

**Reference Books:**

- Manthan Desai Basics of ethical hacking for beginners.
- SunitBelapure and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives.
- Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson.
- Sean-Philip Oriyano, Sybex, Certified Ethical Hacker Study Guide v9, Study Guide Edition,2016.
- Emmett Duley and Chuck Easttom ,Comptia Security+ Study Guide.