SCHEME & SYLLABUS OF POSTGRADUATE DEGREE COURSE
Master of Computer Applications
III-IV Semester

Effective for the students admitted in year 2020-21 and onwards.

Office: Bikaner Technical University, Bikaner
Karni Industrial Area, Pugal Road, Bikaner-334004
Website: https://btu.ac.in

MCA 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	Computer Graphics	Theory	03	03	20	80	100	03
MCA 323	Data Science	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 324	Mobile Application Development Lab	Practical	03	03	60	40	100	03
MCA 325	Computer Graphics	Practical	03	03	60	40	100	03
MCA 326	Data Science Lab Using R	Practical	03	03	60	40	100	03
MCA 327	#Research Paper and Presentation	Practical	02	02	30	20	50	02
Total Credits for III Semester							**850**	**26**
#It is suggested to have Technical Paper Writing Course and in End Term Examination there should be a presentation of a research paper and submit the papers with below 20% Plagiarism report.								

Elective - I

Sr. No.	Course Code	Course Name
1	MCAE331A	Artificial Intelligence & Machine Learning
2	MCAE332A	Internet of Things
3	MCAE333A	Natural Language Processing
4	MCAE334A	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
4.	MCAE344B	Information Security

MCA SECOND YEAR: Semester IV

Course Code	Course Title	Type of Paper	Contact Hours Per Week	Exam Hrs	Internal Assessment	End Term Exam	Total	Credits
MCA 421	Industrial/Field Training	Practical	-	-	150	200	350	09
MCA 422	Dissertation & Seminar	Practical	4	-	60	40	100	03
Total Credits for IV Semester							**450**	**12**
Total Credits for MCA								**90**

Industrial/Field Training: Every candidate shall undertake an Industrial/Field Training during their IV semester in consultation with the faculty guide.

The important points to be considered are:

1. Industrial/Field Training 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.

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

4. Industrial/Field 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.

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 an organization / industry.

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

a. Title Page
b. Certificate from Company
c. Certificate from Guide
d. Acknowledgement
e. 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

SYLLABUS OF
POSTGRADUATE DEGREE COURSE
Master of Computer Applications
III-IV Semester

Effective for the students admitted in year 2020-21 and onwards.

Office: Bikaner Technical University, Bikaner
Karni Industrial Area, Pugal Road, Bikaner-334004
Website: https://btu.ac.in

Course Code: MCA 321
Course Title: Mobile Application Development

Unit	Contents
I	**INTRODUCTION**: 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.
II	**ADVANCED DESIGN**: 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.
III	**TECHNOLOGY I ANDROID**: 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
IV	**Advanced Android:** Using Google Maps, GPS and Wi-Fi Integration, Android Notification, Audio Manager, Bluetooth, Camera and Sensor Integration, Sending SMS, Phone Calls, Publishing Android Application
V	**TECHNOLOGY II IOS**: 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.

Text Books:

- Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
- Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012

Reference Books:

- David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013.
- James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012
- Paul Deitel, Harvey Deitel, Abbey Deitel and Michel Morgano, “Android for Programmers an App-Driven Approach”, Pearson, 2012
- Neil Smyth “Android studio 2.2 Development Essentials 7th Edition” Payload Media 2017
- Jerome Dimarzio “Beginning Android Programming with Android Studio” Wiley Publication

Course Code: MCA 322
Course Title: Computer Graphics

Unit	Contents
I	Elements of graphics workstation, Video Display Devices, Raster Scan Systems, Random Scan systems, Input devices, Graphics Software Coordinate Representations, Fundamental Problems in Geometry, Line drawing algorithms, DDA Algorithm, Bradenham's Line Algorithm, Frame buffers, Circle and Eclipse generating algorithms, Midpoint Circle Algorithm, Sean-line polygon fill algorithm, Inside-Outside tests, Sean- Line fill of curved Boundary Areas. Boundary fill Algorithm, Flood fill Algorithm.
II	Graphics Primitives: Primitive Operations, The display file interpreter-Normalized Device Coordinates, Display- File structure, Display file algorithm, Display control and Polygons, polygon representation, Attributes of output primitives: Line attributes - Line type, Line width, curves, Pen and Brush options, Line Color, Color and gray scale levels, Color-tables, gray scale, Area- Fill Attributes- Fill styles, Pattern fill, soft fill, Character generation, Character Attributes, Text attributes
III	Geometric Transformations: Matrices, Scaling Transformations, Sin and Cos Rotation, Homogeneous Co-ordinates and Translation, Co-ordinate Translations, Rotation about an arbitrary point, Inverse Transformations, Transformations Routines, 2-D Viewing- The viewing pipeline, viewing co-ordinate, Reference Frame, Windows to view ports, co-ordinate transformation 2-D Viewing functions, Clipping operations point clipping, Line clipping. Cohen-Sutherland Line Clipping, Polygon clipping, Sutherland Hodge man clipping.
IV	3-D concepts, Three-dimensional Display Methods Parallel projection, Perspective projection, Visible line and surface identification, Surface rendering, Three-Dimensional Object representations, Bezier curves and surfaces, B -Spline curves and surfaces, Visibility, Image and object precision Z- buffer algorithm, Floating horizons
V	Computer Animation: Design of Animation Sequences, General Computer Animation Functions-Raster Animations, Key Frame Systems, Morphing Simulating Accelerations, Motion Specifications, Kinematics and Dynamics.

Text Books:

- Hearn D and Baker M.P., Computer Graphics, Second Edition, PHI.
- Foley J.D., Van Dam A, Fiener S.K. and Hughes J.F., Computer Graphics, Addison Wesley.
- Newman W.M. and Sproull R.F., Principles of Interactive Computer Graphics, Tata McGraw Hill Publishing Company Limited.

Reference Books:

- Hughes, Van Dam, et al. Computer Graphics Principles and Practice 3e, Pearson, 2014.
- P Shirley, Fundamentals of Computer Graphics, 2e, AK Peters, 2005.

Course Code: MCA 323
Course Title: Data Science

Unit	Contents
I	**Introduction** 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
II	**Introduction to Big Data** 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
III	**Data Science Process** 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
IV	**Statistics** 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
V	**Data Science Tools and Algorithms** 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: Mobile Application Development Lab

List of Experiments
1. Survey of Mobile Application Development Tools. 2. Form design for mobile applications. 3. Applications using controls. 4. Graphical and Multimedia applications. 5. Data retrieval applications. 6. Networking applications. 7. Gaming applications 8. Micro browser-based applications 9. Application explaining the Basic UI Design with all the relevant Fields 10. A Simple application illustrating styles and themes. 11. Call Log Notification Menu. 12. GUI Application. 13. Creating live Folders with search options. 14. A simple database application. 15. A simple offline search Engine.
Text Books: • Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012 • Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012 **Reference Books:** • David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013. • James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012 • Paul Deitel, Harvey Deitel, Abbey Deitel and Michel Morgano, “Android for Programmers an App-Driven Approach”, Pearson, 2012 • Neil Smyth “Android studio 2.2 Development Essentials 7th Edition” Payload Media 2017 • Jerome Dimarzio “Beginning Android Programming with Android Studio” Wiley Publication

Course Code: MCA 325
Course Title: Computer Graphics Lab

List of Experiments
1. Line Drawing Algorithms 2. Circle Drawing Algorithms 3. Ellipse Drawing Algorithms 4. Polygon Filling Algorithms 5. Basic Transformations 6. Composite Transformations 7. Line Clipping Algorithms 8. Polygon Clipping Algorithms 9. Curve Generations 10. Implementation of 2D transformation: Translation, Scaling, Rotation, Mirror reflection and Shearing 11. To perform 2D Transformations such as translation, rotation, scaling, reflection and sharing. 12. To implement Cohen-Sutherland 2D clipping and window-viewport mapping. 13. To perform 3D and greater than 3D Transformations such as translation, rotation and scaling. 14. To visualize projections of 3D and greater than 3D images. 15. Animation
Text Books: • Donald Hearn and M.Pauline Baker, "Computer Graphics C Version", Pearson Education, 2003. • Hughes, Van Dam, et al. Computer Graphics Principles and Practice 3e, Pearson, 2014. • P Shirley, Fundamentals of Computer Graphics, 2e, AK Peters, 2005. **References:** • Foley J.D., Van Dam A, Fiener S.K. and Hughes J.F., Computer Graphics, Addison Wesley. • Digital Animation Bible – AVGERAKIF, Tata McGraw Hill. • Newman W.M. and Sproull R.F., Principles of Interactive Computer Graphics, Tata McGraw Hill Publishing Company Limited.

Course Code: MCA 326
Course Title: Data Science Lab using R

List of Experiments
1. General Properties of R Language 2. Decision Making 3. Loop control 4. Array 5. Vector 6. Matrices 7. Factors 8. Data Frames 9. Packages 10. Data Reshaping 11. Data and File Management 12. Charts & Graphs 13. Graphical Procedures 14. plot function 15. Plot using base graphics 16. Plot using ggplot2

Text Books:

- Sandip Rakshit, R Programming for Beginners, Tata McGraw Hill Publishing Company Limited.
- Niel J le Roux, SugnetLubbe, A step by step tutorial : An introduction into R application and programming, Bookboon Learning

References:

- Hadley Wickham and Garrett Grolemund, “R for Data Science" O’Reilly

Course Code: MCAE 331A
Course Title: Artificial Intelligence and Machine learning

Unit	Contents
I	**INTRODUCTION**: 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	**INTRODUCTION TO SEARCH:** Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning.
III	**KNOWLEDGE REPRESENTATION & REASONING:** Approaches to knowledge representation: Propositional Logic, First Order Predicate Logic, Inference Rules (Modus Ponen, Modus Tollen, Resolution, And elimination, Syllogism), Production Rules, Types of knowledge, Reasoning: Forward and backward reasoning, Non-monotonic Reasoning, Reasoning with uncertainties.
IV	**MACHINE LEARNING:** Machine Learning basics, Why Machine learning, Types of Machine Learning Problems, Applications of ML, Data Mining Vs Machine Learning vs Big Data Analytics. **Supervised Learning-** Naïve Base Classifier, classifying with k-Nearest Neighbour classifier, Decision Tree classifier, Naive Bayes classifier.
V	**UNSUPERVISED LEARNING -** 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, 3rd 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, 1st edition, 1997.
- Winston, Patrick, Henry, "Artificial Intelligence", Pearson Education, 3rd 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, Addision Wesley
- Marcellous, Expert System Programming, PHI
- ShaiShalev-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,

Course Code: MCAE 332A
Course Title: Internet of Thing

Unit	Contents
I	**The Internet of Things:** 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, Logical Design of IoT: Functional block, Communication Models and APIs, IoT Stack.
II	**Enabling Technologies:** 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. The IoT Paradigm: Comparison with User interface related Technologies like SCADA, M2M, SDN. IoT Design Methodology: IoT Components.
III	**Internet Vs Internet of Things:** IoT Layers, IoT Messaging Protocols: MQTT, CoAP. IoT Transport Protocols: BLE, LiFi, Network Protocol: 6LoWPAN. Physical Design of IoT: Functional Block, Cloud Storage Models, Communication Models, and Communication APIs: REST based, Web Socket Based, Cloud for IoT: Challenges, Fog Computing.
IV	**Physical Devices and Endpoints:** Arduino Pin diagram, Arduino Architecture, Arduino Programming, Raspberry Pi Pin diagram, Raspberry Pi Architecture. Sensors and Interfacing: Types of Sensors. Integrating Sensors: HDT (Humidity and Temperature Sensor), Gas Detector, HC-05 (Bluetooth Module), Ultrasonic Sensor, ESP8266 (Wi-Fi Module).
V	**Logical Design of IoT:** Revisiting Python Programming for IoT (Data types, Operators, Control Structures, List, Tuples, Dictionaries, Functions, Modules and File Handling). Python Packages for connecting IoT Devices: Bluetooth, Sockets, Time, Requests, Sys, Adafruit Python DHT, paho-mqtt, Python JSON, Python pip

Text Books:

- S. K. Vasudevan, A. S. Nagarajan, RMD Sundaram, “Internet of Things”, Wiley, 1st Edition, 2014.
- G. C. Hillar, “Internet of Things with Python”, PACKT Publications, 1st Edition, 2016.
- V. Madisetti, A. Bahga, “Internet of Things: A Hands-on Approach”, United Kingdom: Arsheep Bahga & Vijay Madisetti, 1st Edition, 2015.

References:

- J. C. Shovic, “Raspberry Pi IoT Projects: Prototyping Experiments for Makers”, Apress, 1st Edition, 2016.
- M. Schwartz, “Internet of things with the Arduino Yun”, Packt Publishing Ltd., 1st Edition, 2014.
- Hersent, D. Boswarthick, O. Elloumi, “The Internet of Things: Key Applications and Protocols”, John Wiley & Sons, 1st Edition, 2012.
- C. Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus”, Wiley Publishing, 1st Edition, 2013.

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

Unit	Contents
I	**Introduction** 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.
II	**Word Level Analysis**: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.
III	**Syntactic Analysis:** 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
IV	**Semantics And Pragmatics:** Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selection restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods
V	**Discourse Analysis And Lexical Resources**: 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)

Text Books:

- Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014
- Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, O'Reilly Media, 2009

References:

- Breck Baldwin, —Language processing with Java and Ling Pipe Cookbook, Atlantic Publisher, 2015
- Richard M Reese, —Natural Language Processing with Java, O'Reilly Media, 2015
- Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second, Chapman and Hall/CRC Press, 2010
- Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008

Course Code: MCAE 334A
Course Title: Soft Computing

Unit	Contents
I	**Introduction to Soft Computing** 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.
II	**Neural Networks** 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.
III	**Fuzzy Logic** 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, Fuzzyfications & Defuzzificataions, Fuzzy Inference Systems, Mamdani Fuzzy Model, Sugeno Fuzzy Model, Fuzzy Controller, applications.
IV	**Genetic Algorithms** 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.
V	**Hybrid Systems** Integration of neural networks, fuzzy logic and genetic algorithms. GA Based Back Propagation Networks, Fuzzy Back Propagation Networks, Fuzzy Associative Memories, Simplified Fuzzy ARTMAP.

Text Books:

- S. Rajasekaran and G.A.VijaylakshmiPai.. Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India 2007.
- K.H.Lee.. First Course on Fuzzy Theory and Applications, Springer-Verlag.
- D. K. Pratihar, Soft Computing, Narosa, 2008.
- J.-S. R. Jang, C.-T. Sun, and E. Mizutani, Neuro-Fuzzy and soft Computing, PHI Learning, 2009.

References:

- J. Yen and R. Langari.. Fuzzy Logic, Intelligence, Control and Information, Pearson Education.
- N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press.
- Melanie Mitchell, An Introduction to Genetic Algorithms, MIT Press, 2000.
- Simon Haykin, Neural Networks and Learning Machines, (3rd Edn.), PHI Learning, 2011.

Course Code: MCAE 341B
Course Title: Deep Learning

Unit	Contents
I	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.
II	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.
III	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,
IV	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.
V	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,

Text Books:

- Ian Goodfellow, Deep Learning, Second edition, MIT Press, 2016.
- Nicholas Locascio, Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms, O'Reilly, 2017.

References:

- Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, , Cambridge University Press, 2012.
- Aurelien Geron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, O'Reilly, 2017.

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

Unit	Contents
I	**Introduction Web Intelligence:** 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. Information Retrieval: Document representation, Stemming, Term-Document Matrix, Standard Document collections.
II	**Retrieval Model:** Boolean retrieval Model, Vector space retrieval model, probabilistic information Model Evaluation Criteria: Precision and Recall, Confusion Matrix Architecture of a Web Search Engine: The crawler. Indexing systems, queries and ranking. Scalability. Ranking through link analysis.
III	**Multimedia Search:** images, audio and video Image and Short Text Mining: Text Pre-processing: Data Cleaning, Data Integration, Data Transformation, Segmentation Image Pre-Processing: Image histogram analysis, Noise cleaning, Segmentation Classification Algorithms: Linear Regression, Decision Tree, K-means, Naive Bayes
IV	**Understanding Big Data:** What is Big Data? Why Big Data? Big Data Applications, Big Data Analytics, Big Data Challenges. Introduction to NoSQL: Aggregate Data Models, Key-Value and Document Data Models, Graph Databases, Schema Less Databases, Big Data Solutions.
V	**Introduction to Hadoop:** Hadoop architecture, Hadoop Working, Advantages of Hadoop, HDFS Overview, Features of HDFS, HDFS Architecture Map reduce applications: Map Reduce workflows, Hadoop streaming, Components of Hadoop Ecosystem (HBase, Sqoop, Flume, PigLatin scripts. Hive), Apache Spark

Text Books:

- Rajendra Akerkar, Pawan Lingras, "Building an Intelligent Web: Theory and Practice" Front Cover Jones & Bartlett Learning, 2010.
- Data Science and Big Data Analytics, Discovering, Analyzing, Visualizing and Presenting Data, Wiley
- Nathan Marz, James Warren, "Big Data: Principles and Best Practices of Scalable Real Time Data Systems", Manning, 2015
- Dirk De Roos, Melnyk, Bruce Brown, Raefel Coss, "Hadoop For Dummies", John Wiley & Sons, 1st Edition, 2014.
- **References:**
- Zhong, Zhongying, Liu, Jiming, Yao, Yiyu (Eds.), "Web intelligence", Springer, 1st Edition, 2003
- DT Editorial Services, "Big Data Black Book", Dreamtech Press, 2015.

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

Unit	Contents
I	**Fundamentals of Software Quality:** 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
II	**Software Quality Assurance:** 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
III	**Tailoring the Software Quality Assurance System:** 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 Participants in Software Quality Management: Understand SQA management organization, Describe management roles, organization, and activities.
IV	**ASE Tools in Software Quality:** Overview of CASE Tool, Contribution of CASE Tool to Software Product, Software Maintenance and Software Project Quality Software Quality Metrics: Classification, Process Metrics, Product Metrics, Implementation and Limitations.
V	**SQA Standards:** Scope of Quality Standards, Six Sigma, Overview of ISO, CMMI, IEEE standards with examples Costs of Software Quality: Cost of Software Quality Metrics, Classic and extended model of cost of software quality, Application and Problems. Future of Software Quality: SQA Challenges and Capabilities

Text Books:

- Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Addison Wesley, 1st Edition, 2003.
- Stephen Kan, "Metrics and Models in Software Quality Engineering", Addison Wesley, 2nd Edition, 2002.
- Claude Y. Laporte, Alain April, "Software Quality Assurance", Wiley, 1st Edition, 2017.

References:

- Schulmeyer, G. Gordon and McManus, James, (eds), "Handbook of Software Quality Assurance", Prentice Hall, 3rd Edition, 1999.
- 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
- Kshirasagar Naik, Priyadarshi Tripathy, "Software Testing and Quality AssuranceTheory and Practice," Wiley, 1st Edition, 2008.

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Course Title: Information Security

Unit	Contents
I	**Introduction to Information Security:** Definition, Availability, Confidentiality, Accuracy, Integrity and Authenticity. Security Threats: Vulnerabilities, Threats, Attacks and Countermeasures, Secure Software Development.
II	**Ethical Issues in Information Security:** Law and Ethics in Information Security, International Law and Legal bodies, Ethics and Information Security, Codes of Ethics. Managing IT Risk: Introduction, Risk Management, Risk Identification, Risk Assessment, Risk Control Strategies, Risk Control Strategy, Quantitative and Qualitative Risk Control.
III	**Security Plan:** Concept, Information Security Planning and Governance, Policies, Standards, Practices, Information Security with ISO, NIST Models, Security Education, Training and Awareness. Security Technologies: Access Control: Identification, Authentication, Authorization and Accountability.
IV	**Firewalls:** Processing modes, Structure, Architecture, Configuring, Remote User Connections, Access and Authentication. Security Technology: Prevention System, Intrusion Detection: Intrusion Detection and Prevention System, Operating System Fundamentals and Security Tools, Biometrics Access Controls.
V	**Implementing Information Security:** Remote Computing Security, Security Project Management, Technical Aspects of Implementation, Information Security Certifications. Maintenance: Security Management Maintenance Models, Vulnerability Assessment, Introduction to Digital Forensics

Text Books:

- Michael E Whitman and Herbert J Mattord, "Principles of Information Security", CENGAGE Learning, 4th Edition, 2003.
- Mark Merkow, James Breithaupt, "Information Security: Principles and Practices", Pearson Education, 1st Edition, 2007.
- Micki Krause, Harold F. Tipton, "Information Security Management Handbook, CRC Press LLC, 6th Edition, 2004.

References:

- Mark Rhodes, Ousley, "Information Security - The Complete Reference", McGraw Hill Education, 2nd Edition, 2013.
- Matt Bishop, "Computer Security Art and Science", Pearson Education, 2nd Edition, 2002.
- Charles P. Pfleeger and Shari Lawrence Pfleeger, "Security in Computing", PHI, 4th Edition, 2006.
- William Stallings, "Cryptography and Network Security: Principles and Practices", Pearson Education, 4th Edition, 2005.
- Roberta Brag, Mark Rhodes-Ousley, "Network Security - The complete Reference", McGraw Hill Education, 2nd Edition, 2017.