LEARNING OUTCOME BASED CURRICULUM FRAMEWORK

[LOCF]

Sanskar Sarjan Education Society's

DTSS COLLEGE OF COMMERCE

[**AUTONOMOUS**]

PROGRAMME CODE: MIT0022

Master of Science in

Information Technology

[M. Sc. I.T.]

w. e. f. 2021-22

PROGRAMME STRUCTURE

1. **Title of the Program** : M.Sc. in Information Technology
2. **Program Code** : MIT0022
3. **Introduction of the Program**

   M.Sc. in IT is a course which is a Master of Information technology and Master about a technology. A Post postgraduate of Master of Science with the specialization in Machine learning, Artificial Intelligent, and Cloud technology. M.Sc. In Information Technology post-graduation usually takes about two years to complete.
4. **Program Objectives**

   a. Graduates who succeed as leaders at project and enterprise levels.

   b. Graduates who are able to pursue Ph.D. studies.

   c. Graduates who contribute to the development of computer industry.

   d. Graduates who using computer science knowledge contribute to the advancement of other industries
5. **System : CHOICE BASED CREDIT SYSTEM [CBCS]**
6. **Duration of the Program** : 2 years
7. **Total No of Semesters** : 4
8. **Eligibility for Admission :** The Bachelor's degree in the Faculty of Science/ Technology of this University or equivalent degree of recognized Universities with major and ancillary Subjects at undergraduate level as detailed below:

MAJOR	ANCILIARY
Mathematics	–
Physics	Mathematics (4 Units)
Statistics	Mathematics (4 Units)
Life Sciences	Biochemistry or Chemistry with Mathematics or Statistics in first and second year OR Computer Sciences OR Information Technology up to second year of Bachelor's Degree
Medicine	Chemistry/ Microbiology
Bachelor's Degree in Technology (B.Tech./B.E.) in Engineering/ Computer Sciences/ Information Technology	

Bachelor's Degree in Computer Sciences/ B.C.A/B.C.S/ Information Technology

9. **Intake capacity :** 20
10. **Total Credits :** 96
11. **Fee Structure** :
12. **Teacher's Qualification**: Post Graduate in Information Technology/Computer Science or Equivalent one from Recognized University, NET /SET or Ph.D.
13. **Per week Work-load of the Teacher** :
    a. **Theory : 32** periods per week
    b. **Practical : 32** periods per week
14. **Evaluation Pattern** _____
    a. **Total Marks : 960**
    b. **Passing Criteria: 40% in theory as well as in practical.**
    c. **Marking Scheme 60:40**
    d. **Mode of Evaluation of Answer-book : Online/Offline : Offline**
    e. **Paper Pattern**

[A]	Evaluation scheme for Theory courses	Marks
	I. Continuous Internal Assessment (C.I.A.) 1 C.I.A.-I: Test – 20 Marks of 40 mins. duration 2 C.I.A.-II : Assignment/Presentation/Project -15 Marks Active Participation/Attendance -05 Marks	**40 Marks**
	II. Semester End Examination (SEE)	**60 Marks**
Q. 1	Objective/Short Answer (Covering the whole Syllabus)	10 Marks
Q. 2	Answer any two Descriptive	10 Marks
Q. 3	Answer any two Descriptive	10 Marks
Q. 4	Answer any two Descriptive	10 Marks

Q. 5	Answer any two Descriptive	10 Marks
Q. 6	Answer any two Descriptive	10 Marks
[B]	**Evaluation scheme for Practical courses**	**50 Marks**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
Hours 30 min per batch	45 Marks	05 Marks	50 Marks

15. Programme Outcome

Upon completion of the M. Sc. Information Technology programme, learner will be able to:

a. Provides technology-oriented students with the knowledge and ability to develop creative solutions.

b. Develop skills to learn new technology.

c. Apply computer science theory and software development concepts to construct computing-based solutions.

d. Design and develop computer programs/computer-based systems in the areas related to algorithms, networking, web design, cloud computing, Artificial Intelligence, Mobile applications.

Semester- I		
Couse Code	**Course Code**	**Credits**
MSIT101	Research in Computing	4
MSIT102	Data Science	4
MSIT103	Cloud Computing	4
MSIT104	Soft Computing Techniques	4
MSITP101	Research in Computing Practical	2
MSITP102	Data Science Practical	2
MSITP103	Cloud Computing Practical	2
MSITP104	Soft Computing Techniques Practical	2
	Total	**24**

Semester- II		
Couse Code	**Course Code**	**Credits**
MSIT201	Big Data Analytics	4
MSIT202	Modern Networking	4
MSIT203	Micro services Architecture	4
MSIT204	Image Processing	4
MSITP201	Big Data Analytics Practical	2
MSITP202	Modern Networking Practical	2
MSITP203	Micro services Architecture Practical	2
MSITP204	Image Processing Practical	2
	Total	**24**

SEMESTER I

COURSE STRUCTURE

1. **Title of the Course :** Research in Computing
2. **Semester** : I
3. **Course Code: For Theory:** MITCC101
   For Practical: MITCCP101
4. **Course Objective:**
   a. To be able to conduct business research with an understanding of all the latest theories.
   b. To develop the ability to explore research techniques used for solving any real world or innovate problem.
5. **Category of Course** : Core Course
6. **Total Hours**: 60
7. **Total Credits**: 06 Credits (04 Credits for Theory & 02 Credits for Practical)
8. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MITCC 101	Research in Computing	4	3	4	2	6

Module	Detailed Content	Hours
1	**Introduction**: Role of Business Research, Information Systems and Knowledge Management, Theory Building, Organization ethics and Issues	12
2	**Beginning Stages of Research Process**: Problem definition, Qualitative research tools, Secondary data research	12
3	**Research Methods and Data Collection:** Survey research, communicating with respondents, Observation methods, Experimental research	12
4	**Measurement Concepts, Sampling and Field work:** Levels of Scale measurement, attitude measurement, questionnaire design, sampling designs and procedures, determination of sample size	12
5	**Data Analysis and Presentation:** Editing and Coding, Basic Data Analysis, Univariate Statistical Analysis and Bivariate Statistical analysis and differences between two variables. Multivariate Statistical Analysis	12
	Total	60

Sr. No.	List of Practical
1	Import data from different data sources (from Excel, csv, mysql, sql server, oracle to R/Python/Excel)
2	Design a survey form for a given case study, collect the primary data and analyze it.
3	Perform testing of hypothesis using one sample t-test
4	Perform testing of hypothesis using chi-squared goodness-of-fit test.
5	Perform testing of hypothesis using one-way ANOVA.
6	Perform the Random sampling for the given data and analyse it
7	Perform linear regression for prediction
8	Perform multiple linear regression
9	Perform Logistic regression.
10	Perform the Stratified sampling for the given data and analyse it.

9. Evaluation Pattern:

a. **Total Marks** : 150 Marks (10 Point Grading)

b. **Passing Criteria** : 40 % (4 Grade Points)

c. **Marking Scheme** : 60:40:50 Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)
- 50 Marks - Practical Assessment (Passing = 20 Marks)

d. **Mode of Evaluation of Answer-books** : Online/Offline

10. Paper Pattern:

a. **Internal Assessment:**

- Assessment consists of a class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
- Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination :**

Question No.	Description	Marks
1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10

4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

11. Course Outcome:

Upon successful completion of this course, students should be able to:

CO1: Solve real world problems with scientific approach
CO2: Develop analytical skills by applying scientific methods.
CO3: Recognize, understand and apply the language, theory and models of the field of business analytics
CO4: Foster an ability to critically analyse, synthesize and solve complex unstructured business Problems.
CO5: Understand and critically apply the concepts and methods of business analytics
CO6: identify model and solve decision problems in different settings
CO7: create viable solutions to decision making problems

12. References:

1. Business Research Methods, By William G.Zikmund, B.J Babin, J.C. Carr, Atanu Adhikari, M.Griffin, 8e, 2016
2. Business Analytics by Albright Winston, 5e, 2015
3. Research Methods for Business Students Fifth Edition, by Mark , 2011

COURSE STRUCTURE

1. **Title of the Course :** Data Science
2. **Semester** : I
3. **Course Code: For Theory:** MITCC102
   For Practical: MITCCP102
4. **Course Objective:**

   a. To explain idea of data analysis techniques and quantitative modeling for the solution of real world business problems.
   b. To report findings of analysis and effectively present them using data visualization techniques.
   c. To demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
   d. To provide insights about the roles of a Data Scientist, such as a developer, an analyst, a statistical expert etc.
   e. To understand techniques and tools for transformation of data, Data Mining, Data formats, Machine Learning Algorithms, Data Visualization and Optimization.

5. **Category of Course**: Core Course
6. **Total Hours**: 60
7. **Total Credits**: 06 Credits (04 Credits for Theory & 02 Credits for Practical)
8. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MITCC102	Data Science	5	3	4	2	6

Module	Detailed Content	Hours
1	**Data Science Technology Stack:** Rapid Information Factory Ecosystem, Data Science Storage Tools, Data Lake, Data Vault, Data Warehouse Bus Matrix, Data Science Processing Tools ,Spark, Mesos, Akka , Cassandra, Kafka, Elastic Search, R ,Scala, Python, MQTT, The Future **Layered Framework:** Definition of Data Science Framework, Cross-Industry Standard Process for Data Mining (CRISP-DM), Homogeneous Ontology for Recursive Uniform Schema, The Top	12

	Layers of a Layered Framework, Layered Framework for High-Level Data Science and Engineering. **Business Layer:** Business Layer, Engineering a Practical Business Layer. **Utility Layer:** Basic Utility Design, Engineering a Practical Utility Layer.	
2	**Three Management Layers:** Operational Management Layer, Processing-Stream Definition and Management, Audit, Balance, and Control Layer, Balance, Control, Yoke Solution, Cause-and-Effect, Analysis System, Functional Layer, Data Science Process. **Retrieve Superstep :** Data Lakes, Data Swamps, Training the Trainer Model, Understanding the Business Dynamics of the Data Lake, Actionable Business Knowledge from Data Lakes, Engineering a Practical Retrieve Superstep, Connecting to Other Data Sources.	12
3	**Assess Superstep:** Assess Superstep, Errors, Analysis of Data, Practical Actions, Engineering a Practical Assess Superstep.	12
4	**Process Superstep :** Data Vault, Time-Person-Object-Location-Event Data Vault, Data Science Process, Data Science. **Transform Superstep :** Transform Superstep, Building a Data Warehouse, Transforming with Data Science, Hypothesis Testing, Overfitting and Underfitting, Precision-Recall, Cross-Validation Test.	12
5	**Transform Superstep:** Univariate Analysis, Bivariate Analysis, Multivariate Analysis, Linear Regression, Logistic Regression, Clustering Techniques, ANOVA, Principal Component Analysis (PCA), Decision Trees, Support Vector Machines, Networks, Clusters, and Grids, Data Mining, Pattern Recognition, Machine Learning, Bagging Data,Random Forests, Computer Vision (CV) , Natural Language Processing (NLP), Neural Networks, Tensor Flow. **Organize and Report Supersteps :** Organize Superstep, Report Superstep, Graphics, Pictures, Showing the Difference	12
	Total	60

Sr. No.	List of Practical
1	Creating Data Model using Cassandra.
2	Conversion from different formats to HOURS format. a. Text delimited csv format. b. XML c. JSON

	d. MySQL Database e. Picture (JPEG) f. Video g. Audio
3	Utilities and Auditing
4	Retrieving Data
5	Assessing Data
6	Processing Data
7	Transforming Data
8	Organizing Data
9	Generating Reports
10	Data Visualization with Power BI

9. Evaluation Pattern:

a. **Total Marks** : 150 Marks (10 Point Grading)

b. **Passing Criteria** : 40 % (4 Grade Points)

c. **Marking Scheme** : 60:40:50 Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)
- 50 Marks - Practical Assessment (Passing = 20 Marks)

d. **Mode of Evaluation of Answer-books** : Online/Offline

10. Paper Pattern:

a. **Internal Assessment:**

- Assessment consists of a class test of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
- Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination :**

Question No.	Description	Marks
1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10

3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

11. Course Outcome:

Upon successful completion of this course, students should be able to:

CO1: Develop relevant programming abilities.

CO2: Demonstrate proficiency with statistical analysis of data.

CO3: Develop the ability to build and assess data-based models.

CO4: Execute statistical analyses with professional statistical software.

CO5: Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

CO6: Formulate simple algorithms to solve problems, and can code them in a high-level language appropriate for data science work (e.g., Python, SQL, R, Java).

CO7: Integrate data from disparate sources, can transform data from one format to another, and can program data management in relational databases.

12. References:

1. Practical Data Scienceby Andreas François Vermeulen , APress, 2018.
2. Principles of Data Science by Sinan Ozdemir, PACKT, 2016.
3. Data Science from Scratch by Joel Grus, O'Reilly, 2015.
4. Data Science from Scratch first Principle in python by Joel Grus, Shroff Publishers, 2017.
5. Experimental Design in Data science with Least Resources by N C Das, Shroff Publishers, 2018.

COURSE STRUCTURE

1. **Title of the Course :** Cloud Computing
2. **Semester** : I
3. **Course Code: For Theory:** MITCC103
   For Practical: MITCCP103
4. **Course Objective:**
   a. To understand data warehouse concepts, architecture, business analysis and tools
   b. To learn how to use Cloud Services.
   c. To implement Virtualization.
   d. To implement Task Scheduling algorithms.
   e. Apply Map-Reduce concept to applications. To build Private Cloud
5. **Category of Course** : Core Course
6. **Total Hours**: 60
7. **Total Credits**: 06 Credits (04 Credits for Theory & 02 Credits for Practical)
8. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MITCC103	Cloud Computing	4	3	4	2	6

Module	Detailed Content	Hours
1	**Introduction to Cloud Computing:** Introduction, Historical developments, Building Cloud Computing Environments, **Principles of Parallel and Distributed Computing:** Eras of Computing, Parallel v/s distributed computing, Elements of Parallel Computing, Elements of distributed computing, Technologies for distributed computing. **Virtualization**: Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples. Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud usage monitor, Resource replication, Ready-made environment.	12
2	**Cloud Computing Architecture:** Introduction, Fundamental concepts and models, Roles and boundaries, Cloud Characteristics, Cloud Delivery models, Cloud Deployment models, Economics of the cloud, Open challenges. **Fundamental Cloud Security:** Basics, Threat agents, Cloud	12

	security threats, additional considerations. **Industrial Platforms and New Developments:** Amazon Web Services, Google App Engine, Microsoft Azure.	
3	**Specialized Cloud Mechanisms:** Automated Scaling listener, Load Balancer, SLA monitor, Pay-per-use monitor, Audit monitor, fail over system, Hypervisor, Resource Centre, Multi device broker, State Management Database. **Cloud Management Mechanisms:** Remote administration system, Resource Management System, SLA Management System, Billing Management System, **Cloud Security Mechanisms:** Encryption, Hashing, Digital Signature, Public Key Infrastructure (PKI), Identity and Access Management (IAM), Single 12 11 Sign-On (SSO), Cloud-Based Security Groups, Hardened Virtual Server Images	12
4	**Fundamental Cloud Architectures:** Workload Distribution Architecture, Resource Pooling Architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, Elastic Disk Provisioning Architecture, Redundant Storage Architecture. **Advanced Cloud Architectures:** Hypervisor Clustering Architecture, Load Balanced Virtual Server Instances Architecture, Non-Disruptive Service Relocation Architecture, Zero Downtime Architecture, Cloud Balancing Architecture, Resource Reservation Architecture, Dynamic Failure Detection and Recovery Architecture, Bare-Metal Provisioning Architecture, Rapid Provisioning Architecture, Storage Workload Management Architecture	12
5	**Cloud Delivery Model Considerations:** Cloud Delivery Models: The Cloud Provider Perspective, Cloud Delivery Models: The Cloud Consumer Perspective, **Cost Metrics and Pricing Models:** Business Cost Metrics, Cloud Usage Cost Metrics, Cost Management Considerations, **Service Quality Metrics and SLAs:** Service Quality Metrics, SLA Guidelines	12
	Total	60

Sr. No.	List of Practical
1	Write a program for implementing Client Server communication model using TCP. a. A client server based program using TCP to find if the number entered is prime b. A client server TCP based chatting application
2	Write a program for implementing Client Server communication model using UDP a. A client server based program using UDP to find if the number entered is even or odd. b. A client server based program using UDP to find the factorial of the

	entered number. c. A program to implement simple calculator operations like addition, subtraction, multiplication and division. d. A program that finds the square, square root, cube and cube root of the entered number
3	A multicast Socket example
4	Write a program to show the object communication using RMI a. A RMI based application program to display current date and time. b. A RMI based application program that converts digits to words, e.g. 123 will be converted to one two three.
5	Show the implementation of web services. a. Implementing "Big" Web Service. b. Implementing Web Service that connects to MySQL database.
6	Implement Xen virtualization and manage with Xen Center
7	Implement virtualization using VMWare ESXi Server and managing with vCenter
8	Implement Windows Hyper V virtualization
9	Develop application for Microsoft Azure.
10	Develop application for Google App Engine

9. Evaluation Pattern:

a. **Total Marks** : 150 Marks (10 Point Grading)

b. **Passing Criteria** : 40 % (4 Grade Points)

c. **Marking Scheme** : 60:40:50 Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)
- 50 Marks - Practical Assessment (Passing = 20 Marks)

d. **Mode of Evaluation of Answer-books** : Online/Offline

10. Paper Pattern:

a. **Internal Assessment:**

- Assessment consists of a class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
- Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination :**

Question No.	Description	Marks
1	Objectives or Short Answers (Covering All Modules)	10

2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

11. Course Outcome:

Upon successful completion of this course, students should be able to:

CO1: Analyze the Cloud computing setup with its vulnerabilities and applications using different architectures.

CO2: Design different workflows according to requirements and apply map reduce programming model.

CO3: Apply and design suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms.

CO4: Create combinatorial auctions for cloud resources and design scheduling algorithms for computing clouds.

C05: Assess cloud Storage systems and Cloud security, the risks involved, its impact and develop cloud application

12. References:

1. Mastering Cloud Computing Foundations and Applications Programming by Rajkumar Buyya,Christian Vecchiola, S. Thamarai Selvi, 2013
2. Cloud Computing Concepts, Technology & Architecture by Thomas Erl, Zaigham Mahmood,and Ricardo Puttini, 2013
3. Distributed and Cloud Computing, From Parallel Processing to the Internet of Things by Kai Hwang, Jack Dongarra, Geoffrey Fox, 2012

COURSE STRUCTURE

1. **Title of the Course:** Soft Computing Techniques
2. **Semester**: I
3. **Course Code: For Theory:** MITCC104
   For Practical: MITCCP104
4. **Course Objective:**

   This course aims
   a. To introduce learners to soft computing concepts and techniques and foster their abilities in designing and implementing soft computing-based solutions for real-world and engineering problems.
   b. To introduce learners to fuzzy systems, fuzzy logic and its applications.
   c. To explain the learners about Artificial Neural Networks and various categories of ANN.
   d. To explain the learners about Genetic Algorithm and various categories of it.
5. **Category of Course**: Core
6. **Total Hours**: 60
7. **Total Credits**: 06 Credits (04 Credits for Theory & 02 Credits for Practical)
8. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MITCC104	Soft Computing	5	3	4	2	6

Module	Detailed Content	Hours
1	Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Classification, Clustering, Bayesian Networks, Probabilistic reasoning, applications of soft computing.	12
2	Artificial Neural Network: Fundamental concept, Evolution of Neural Networks, Basic Models, McCulloh-Pitts Neuron, Linear Separability, Hebb Network. Supervised Learning Network: Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neurons, Backpropagation Network, Radial Basis Function, Time Delay Network, Functional Link Networks, Tree Neural Network. Associative Memory Networks: Training algorithm for pattern Association, Autoassociative memory network, hetroassociative	12

	memory network, bi-directional associative memory, Hopfield networks, iterative autoassociative memory networks, temporal associative memory networks.	
3	UnSupervised Learning Networks: Fixed weight competitive nets, Kohonen self-organizing feature maps, learning vectors quantization, counter propogation networks, adaptive resonance theory networks. Special Networks: Simulated annealing, Boltzman machine, Gaussian Machine, Cauchy Machine, Probabilistic neural net, cascade correlation network, cognition network, neo-cognition network, cellular neural network, optical neural network. Third Generation Neural Networks: Spiking Neural networks, convolutional neural networks, deep learning neural networks, extreme learning machine model.	12
4	Introduction to Fuzzy Logic, Classical Sets and Fuzzy sets: Classical sets, Fuzzy sets. Classical Relations and Fuzzy Relations: Cartesian Product of relation, classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Membership Function: features of the membership functions, fuzzification, methods of membership value assignments. Defuzzification: Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods. Fuzzy Arithmetic and Fuzzy measures: fuzzy arithmetic, fuzzy measures, measures of fuzziness, fuzzy integrals.	12
5	Fuzzy Rule base and Approximate reasoning: Fuzzy proportion, formation of rules, decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, Fuzzy logic control systems, control system design, architecture and operation of FLC system, FLC system models and applications of FLC System. Genetic Algorithm: Biological Background, Traditional optimization and search techniques, genetic algorithm and search space, genetic algorithm vs. traditional algorithms, basic terminologies, simple genetic algorithm, general genetic algorithm, operators in genetic algorithm, stopping condition for genetic algorithm flow, constraints in genetic algorithm, problem solving using genetic algorithm, the schema theorem, classification of genetic algorithm, Holland classifier systems, genetic programming, advantages and limitations and applications of genetic algorithm. Differential Evolution Algorithm, Hybrid soft computing techniques – neuro – fuzzy hybrid, genetic neuro-hybrid systems, genetic fuzzy hybrid and fuzzy genetic hybrid systems.	12
	Total	60

Sr. No.	List of Practical
1.	Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.
2.	Create a simple ADALINE network with appropriate no. of input and output nodes. Train it using delta learning rule until no change in weights is required. Output the final weights.
3.	Train the autocorrelator by given patterns: A1=(-1,1,-1,1), A2=(1,1,1,-1), A3=(-1, -1, - 1, 1). Test it using patterns: Ax=(-1,1,-1,1), Ay=(1,1,1,1), Az=(-1,-1,-1,-1).
4.	Train the hetrocorrelator using multiple training encoding strategy for given patterns: A1=(000111001), B1=(010000111), A2=(111001110) B2=(100000001), A3=(110110101) B3(101001010). Test it using pattern A2.
5.	Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform maxmin composition on any two fuzzy relations.
6.	Solve Greg Viot's fuzzy cruise controller using MATLAB Fuzzy logic toolbox.
7.	Solve Air Conditioner Controller using MATLAB Fuzzy logic toolbox.
8.	Implement TSP using GA.

9. Evaluation Pattern:

a. **Total Marks:** 150 Marks (10 Point Grading)

b. **Passing Criteria**: 40 % (4 Grade Points)

c. **Marking Scheme:** 60:40:50 Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)
- 50 Marks - Practical Assessment (Passing = 20 Marks)

d. **Mode of Evaluation of Answer-books:** Online/Offline

10. Paper Pattern:

a. **Internal Assessment:**

- Assessment consists of a class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
- Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination:**

Question No.	Description	Marks
1	Objectives or Short Answers (Covering All Modules)	10

2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each.

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

11. Course Outcome:

On successful completion of this course, the Learner should be able to:

CO1: Understand soft computing techniques and their role in problem solving.

CO2: Conceptualize and parameterize various problems to be solved through basic soft computing techniques.

CO3: Analyse and integrate various soft computing techniques in order to solve problems effectively and efficiently.

12. References:

1. Neural Networks, Fuzzy Logic & Genetic Algorithm: Synthesis and Applications by S. Rajasekaran & G. A. Vijayalakshmi Pai, Phi, 2003.
2. Soft Computing: Methodologies and Applications by Hoffmann, F., Koeppen, M., Klawonn, F. & Roy, R., Springer, 2005.
3. Principles of Soft Computing by S. N. Sivanandam & S.N. Deepa, Wiley, 2007.
4. Genetic Algorithms by David E. Goldberg, Pearson Education India, 2006.
5. Soft Computing and Its Applications by Rafik Aziz, O. Aliev, R. R. Aliev, World Scientific, 2001.
6. Artificial Neural Networks by B. Yagnanarayana, PHI, 2009.
7. Neural Networks and Learning Machines by Simon O. Haykin, 3rd Edition, Prentice Hall, 2009.

COURSE STRUCTURE

1. **Title of the Course :** Big Data Analytics
2. **Semester** : I
3. **Course Code: For Theory:** MITCC201
   For Practical: MITCCP201
4. **Course Objective:**

   a. To provide an overview of an exciting growing field of big data analytics.
   b. To introduce the tools required to manage and analyze big data like Hadoop, NoSql, MapReduce.
   c. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
   d. To enable students to have skills that will help them to solve complex realworld problems in for decision support.

5. **Category of Course**: Core Course
6. **Total Hours**: 60
7. **Total Credits**: 06 Credits (04 Credits for Theory & 02 Credits for Practical)
8. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MITCC201	Big-Data Analytics	5	3	4	2	6

Module	Detailed Content	Hours
1	Introduction to Big Data, Characteristics of Data, and Big Data Evolution of Big Data, Definition of Big Data, Challenges with big data, Why Big data? Data Warehouse environment, Traditional Business Intelligence versus Big Data. State of Practice in Analytics, Key roles for New Big Data Ecosystems, Examples of big Data Analytics. Big Data Analytics, Introduction to big data analytics, Classification of Analytics, Challenges of Big Data, Importance of Big Data, Big Data Technologies, Data Science, Responsibilities, Soft state eventual consistency. Data Analytics Life Cycle	12

2	Analytical Theory and Methods: Clustering and Associated Algorithms, Association Rules, Apriori Algorithm, Candidate Rules, Applications of Association Rules, Validation and Testing, Diagnostics, Regression, Linear Regression, Logistic Regression, Additional Regression Models.	12
3	Analytical Theory and Methods: Classification, Decision Trees, Naïve Bayes, Diagnostics of Classifiers, Additional Classification Methods, Time Series Analysis, Box Jenkins methodology, ARIMA Model, Additional methods. Text Analysis, Steps, Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency-Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments	12
4	Data Product, Building Data Products at Scale with Hadoop, Data Science Pipeline and Hadoop Ecosystem, Operating System for Big Data, Concepts, Hadoop Architecture, Working with Distributed file system, Working with Distributed Computation, Framework for Python and Hadoop Streaming, Hadoop Streaming, MapReduce with Python, Advanced MapReduce. In-Memory Computing with Spark, Spark Basics, Interactive Spark with PySpark, Writing Spark Applications.	12
5	Distributed Analysis and Patterns, Computing with Keys, Design Patterns, Last-Mile Analytics, Data Mining and Warehousing, Structured Data Queries with Hive, HBase, Data Ingestion, Importing Relational data with Sqoop, Injesting stream data with flume. Analytics with higher level APIs, Pig, Spark's higher level APIs.	12
	Total	60

10 Practical based on above syllabus, covering entire syllabus.

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9. Evaluation Pattern:

a. **Total Marks** : 150 Marks (10 Point Grading)

b. **Passing Criteria** : 40 % (4 Grade Points)

c. **Marking Scheme** : 60:40:50 Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)
- 50 Marks - Practical Assessment (Passing = 20 Marks)

d. **Mode of Evaluation of Answer-books** : Online/Offline

10. Paper Pattern:

a. **Internal Assessment:**

- Assessment consists of a class test of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
- Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination :**

Question No.	Description	Marks
1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

11. Course Outcome:

Upon successful completion of this course, students should be able to:

CO1: Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.

CO2: Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.

CO3: Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.

CO4: Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

12. References:

1. Big Data and Analytics by Subhashini Chellappan Seema Acharya, Wiley.
2. Data Analytics with Hadoopm An Introduction for Data Scientists Benjamin Bengfort and Jenny Kim,2016.

3. Big Data and Hadoop by V.K Jain, Khanna Publishing, 2018.

COURSE STRUCTURE

1. **Title of the Course :** Modern Networking
2. **Semester** : II
3. **Course Code: For Theory :** MITCC202
   For Practical: MITCCP202
4. **Course Objective:**

   a. To understand the state-of-the-art in network protocols, architectures and applications.
   b. Analyze existing network protocols and networks.
   c. To understand how networking research is done
   d. Develop new protocols in networking
   e. To investigate novel ideas in the area of Networking via term-long researchprojects.

5. **Category of Course** : Core Course
6. **Total Hours**: 60
7. **Total Credits**: 06 Credits (04 Credits for Theory & 02 Credits for Practical)
8. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MITCC202	Modern Networking	4	3	4	2	6

Module	Detailed Content	Hours
1	Modern Networking Elements of Modern Networking The Networking Ecosystem ,Example Network Architectures,Global Network Architecture,A Typical Network Hierarchy Ethernet Applications of Ethernet Standards Ethernet Data Rates Wi-Fi Applications of Wi-Fi,Standards Wi-Fi Data Rates 4G/5G Cellular First Generation Second Generation, Third Generation Fourth Generation Fifth Generation, Cloud Computing Cloud Computing Concepts The Benefits of Cloud Computing Cloud Networking Cloud Storage, Internet of Things Things on the Internet of Things, Evolution Layers of the Internet of Things, Network Convergence Unified Communications, Requirements and Technology Types of Network and Internet Traffic,Elastic Traffic,Inelastic Traffic, Real-Time	12

	TrafficCharacteristics Demand: Big Data, Cloud Computing, and Mobile TrafficBig Data Cloud Computing,,Mobile Traffic, Requirements: QoS and QoE,,Quality of Service,Quality of Experience, Routing Characteristics, Packet Forwarding, Congestion Control ,Effects of Congestion,Congestion Control Techniques, SDN and NFV Software- Defined Networking,Network Functions Virtualization ModernNetworking Elements	
2	Software-Defined Networks SDN: Background and Motivation, Evolving Network Requirements Demand Is Increasing,Supply Is IncreasingTraffic Patterns Are More ComplexTraditional Network Architectures are Inadequate, The SDN Approach Requirements SDN Architecture Characteristics of Software- Defined Networking, SDN- and NFV-Related Standards Standards- Developing Organizations Industry Consortia Open Development Initiatives, SDN Data Plane and OpenFlow SDN Data Plane, Data Plane Functions Data Plane Protocols OpenFlow Logical Network Device Flow Table Structure Flow Table Pipeline, The Use of Multiple Tables Group Table OpenFlow Protocol, SDN Control Plane SDN Control Plane Architecture Control Plane Functions, Southbound Interface Northbound InterfaceRouting, ITU-T Model, OpenDaylight OpenDaylight Architecture OpenDaylight Helium, REST REST Constraints Example REST API, Cooperation and Coordination Among Controllers, Centralized Versus Distributed Controllers, High-Availability Clusters Federated SDN Networks, Border Gateway Protocol Routing and QoS Between Domains, Using BGP for QoS Management IETF SDNi OpenDaylight SNDi SDN Application Plane SDN Application Plane Architecture Northbound Interface Network Services Abstraction Layer Network Applications, User Interface, Network Services Abstraction Layer Abstractions in SDN, Frenetic Traffic Engineering PolicyCop Measurement and Monitoring Security OpenDaylight DDoS Application Data Center Networking, Big Data over SDN Cloud Networking over SDN Mobility and Wireless Information-Centric Networking CCNx, Use of an Abstraction Layer	12
3	Virtualization, Network Functions Virtualization: Concepts and	12

	Architecture, Background and Motivation for NFV, Virtual Machines The Virtual Machine Monitor, Architectural Approaches Container Virtualization, NFV Concepts Simple Example of the Use of NFV, NFV Principles High-Level NFV Framework, NFV Benefits and Requirements NFV Benefits, NFV Requirements, NFV Reference Architecture NFV Management and Orchestration, Reference Points Implementation, NFV Functionality, NFV Infrastructure,Container Interface,Deployment of NFVI Containers,Logical Structure of NFVI Domains,Compute Domain, Hypervisor Domain,Infrastructure Network Domain, Virtualized Network Functions, VNF Interfaces,VNFC to VNFC Communication,VNF Scaling, NFV Management and Orchestration, Virtualized Infrastructure Manager,Virtual Network Function Manager,NFV Orchestrator, Repositories, Element Management, OSS/BSS, NFV Use Cases Architectural Use Cases, Service-Oriented Use Cases, SDN and NFV Network Virtualization, Virtual LANs ,The Use of Virtual LANs,Defining VLANs, Communicating VLAN Membership,IEEE 802.1Q VLAN Standard, Nested VLANs, OpenFlow VLAN Support, Virtual Private Networks, IPsec VPNs,MPLS VPNs, Network Virtualization, Simplified Example, Network Virtualization Architecture, Benefits of Network Virtualization, OpenDaylight’s Virtual Tenant Network, Software-Defined	

	Infrastructure,Software- Defined Storage, SDI Architecture	
4	Defining and Supporting User Needs, Quality of Service, Background, QoS Architectural Framework, Data Plane, Control Plane, Management Plane, Integrated Services Architecture, ISA Approach ISA Components, ISA Services, Queuing Discipline, Differentiated Services, Services, DiffServ Field, DiffServ Configuration and Operation, Per-Hop Behavior, Default Forwarding PHB, Service Level Agreements, IP Performance Metrics, OpenFlow QoS Support, Queue Structures, Meters, QoE: User Quality of Experience, Why QoE?,Online Video Content Delivery, Service Failures Due to Inadequate QoE Considerations QoE-Related Standardization Projects, Definition of Quality of Experience, Definition of Quality, Definition of Experience Quality Formation Process, Definition of Quality of Experience, QoE Strategies in Practice, The QoE/QoS Layered Model Summarizing and Merging the ,QoE/QoS Layers, Factors Influencing QoE, Measurements of QoE, Subjective Assessment, Objective Assessment, End-User Device Analytics, Summarizing the QoE Measurement Methods, Applications of QoE Network Design Implications of QoS and QoE Classification of QoE/ QoS Mapping Models, Black-Box Media-Based QoS/QoE Mapping Models, Glass- Box Parameter-Based QoS/QoE Mapping Models,Gray-Box QoS/QoE Mapping Models, Tips for QoS/QoE Mapping Model Selection,IP- Oriented Parameter-Based QoS/QoE Mapping Models,Network Layer QoE/QoS Mapping Models for Video Services, Application Layer QoE/QoS Mapping Models for Video Services Actionable QoE over IP-Based Networks, The System-Oriented Actionable QoE Solution, The Service-Oriented Actionable QoE Solution, QoE Versus QoS Service Monitoring, QoS Monitoring Solutions, QoE Monitoring Solutions, QoE-Based Network and Service Management, QoE-Based Management of VoIP Calls, QoE-Based Host-Centric Vertical Handover, QoE-Based Network-Centric Vertical Handover	12
5	Modern Network Architecture: Clouds and Fog, Cloud Computing, Basic Concepts, Cloud Services, Software as a Service, Platform as a Service, Infrastructure as a Service, Other Cloud Services, XaaS, Cloud Deployment Models, Public Cloud Private Cloud Community Cloud, Hybrid Cloud,	12

	Cloud Architecture, NIST Cloud Computing Reference Architecture,ITU-T Cloud Computing Reference Architecture, SDN and NFV, Service Provider Perspective Private Cloud Perspective, ITU-T Cloud Computing Functional Reference Architecture, The Internet of Things: Components The IoT Era Begins, The Scope of the Internet of Things Components of IoT-Enabled Things, Sensors, Actuators, Microcontrollers, Transceivers, RFID, The Internet of Things: Architecture and Implementation, IoT Architecture,ITU-T IoT Reference Model, IoT World Forum Reference Model, IoT Implementation, IoTivity, Cisco IoT System, ioBridge, Security Security Requirements, SDN Security Threats to SDN, Software- Defined Security, NFV Security, Attack Surfaces, ETSI Security Perspective, Security Techniques, Cloud Security, Security Issues and Concerns, Cloud Security Risks and Countermeasures, Data Protectionin the Cloud, Cloud Securityas a Service, Addressing Cloud Computer Security Concerns, IoT Security, The Patching Vulnerability, IoT Security and Privacy Requirements Defined by ITU-TAn IoT Security Framework, Conclusion	
	Total	60

Sr. No	**List of Practical**
1.	Configure IP SLA Tracking and Path Control Topology
2.	Using the AS_PATH Attribute
3.	Configuring IBGP and EBGP Sessions, Local Preference, and MED
4.	Secure the Management Plane
5.	Configure and Verify Path Control Using PBR
6.	IP Service Level Agreements and Remote SPAN in a Campus Environment
7.	Inter-VLAN Routing
8.	Simulating MPLS environment
9.	Simulating VRF

10.	Simulating SDN with • OpenDaylight SDN Controller with the Mininet Network Emulator • OFNet SDN network emulator
11.	Simulating OpenFlow Using MININET

9. Evaluation Pattern:

a. **Total Marks** : 150 Marks (10 Point Grading)

b. **Passing Criteria** : 40 % (4 Grade Points)

c. **Marking Scheme** : 60:40:50 Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)
- 50 Marks - Practical Assessment (Passing = 20 Marks)

d. **Mode of Evaluation of Answer-books** : Online/Offline

10. Paper Pattern:

a. **Internal Assessment:**

- Assessment consists of a class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
- Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination :**

Question No.	Description	Marks
1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

11. **Course Outcome:**

Upon successful completion of this course, students should be able to develop application

CO1: Demonstrate in-depth knowledge in the area of Computer Networking.

CO2: To demonstrate scholarship of knowledge through performing in a group to identify, formulate and solve a problem related to Computer Networks.

CO3: Prepare a technical document for the identified Networking System Conducting experiments to analyze the identified research work in building Computer Networks.

12. **References:**

1. Foundations of Modern Networking: SDN, NFV,QoE, IoT, and Cloud by William Stallings, Publisher Addison-Wesley Professional
2. SDN and NFV Simplified A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization by Jim Doherty
3. Network Functions Virtualization (NFV) with a Touch of SD by Rajendra Chayapathi Syed Farrukh HassanN
4. CCIE and CCDE Evolving Technologies Study Guide by Brad dgeworth,Jason Gooley,Ramiro Garza Rios

COURSE STRUCTURE

1. **Title of the Course :** Micro Services Architecture
2. **Semester** : II
3. **Course Code: For Theory :** MITCC203
   For Practical: MITCCP203
4. **Course Objective:**

   a. Gain a thorough understanding of the philosophy and architecture ofWeb applications using ASP.NET Core MVC.
   b. Gain a practical understanding of.NET Core
   c. Acquire a working knowledge of Web application development usingASP.NET Core MVC 6 and Visual Studio.
   d. Persist data with XML Serialization and ADO.NET with SQL Server.
   e. Create HTTP services using ASP.NET Core Web API.
   f. Deploy ASP.NET Core MVC applications to the Windows Azure cloud

5. **Category of Course** : Core Course
6. **Total Hours**: 60
7. **Total Credits**: 06 Credits (02 Credits for Theory & 02 Credits for Practical)
8. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MIT203	Micro Services Architecture	4	3	4	2	6

Module	Detailed Content	Hours
1	**Microservices:** Understanding Microservices, Adopting Microservices, The Microservices Way. **Microservices ValueProposition:** Deriving Business Value, defining a Goal-Oriented,Layered Approach, Applying the Goal-Oriented, Layered Approach. **Designing Microservice Systems:** The Systems Approach toMicroservices, A Microservices Design Process, **Establishing a Foundation:** Goals and Principles, Platforms, Culture.	12
2	**Service Design:** Microservice Boundaries, API design for Microservices, Data and Microservices, Distributed Transactions and Sagas, Asynchronous Message-Passing and Microservices, dealing with Dependencies, **System Design**	12

	and Operations: Independent Deployability, More Servers, Docker and Microservices, Role of Service Discovery, Need for an API Gateway, Monitoring and Alerting. **Adopting Microservices in Practice:** Solution Architecture Guidance, Organizational Guidance, Culture Guidance, Tools and Process Guidance, Services Guidance.	
3	**Building Microservices with ASP.NET Core:** Introduction, Installing .NET Core, Building a Console App, Building ASP.NET Core App. **Delivering Continuously:** Introduction to Docker, Continuous integration with Wercker, Continuous Integration withCircle CI, Deploying to Dicker Hub. **Building Microservice with ASP.NET Core:** Microservice, Team Service, API First Development,Test First Controller, Creating a CI pipeline, Integration Testing, Running the team service Docker Image. **Backing Services:**Microservices Ecosystems, Building the location Service, EnhancingTeam Service.	12
4	**Creating Data Service:** Choosing a Data Store**,** Building a Postgres Repository, Databases are Backing Services, Integration Testing Real Repositories, Exercise the Data Service.**Event Sourcing and CQRS:** Event Sourcing, CQRS pattern, Event Sourcing and CQRS, Running the samples. **Building an ASP.NET Core Web Application:** ASP.NET Core Basics, Building Cloud-Native Web Applications. **Service Discovery:** Cloud Native Factors, Netflix Eureka, Discovering and Advertising ASP.NET Core Services. DNS and Platform SupportedDiscovery.	12
5	**Configuring Microservice Ecosystems:** Using Environment Variables with Docker, Using Spring Cloud Config Server, Configuring Microservices with etcd, **Securing Applications and Microservices:** Security in the Cloud, Securing ASP.NET Core Web Apps, Securing ASP.NET Core Microservices. **Building Real-Time Apps and Services:** Real-Time Applications Defined, Websockets in the Cloud, Using a Cloud Messaging Provider, Building the Proximity Monitor. **Putting It All Together:** Identifying and Fixing Anti-Patterns, Continuing the Debate over Composite Microservices, The Future.	12
	Total	60

Sr. No	**List of Practical**

1.	Building APT.NET Core MVC Application.
2.	Building ASP.NET Core REST API.
3.	Working with Docker, Docker Commands, Docker Images and Containers
4.	Installing software packages on Docker, Working with Docker Volumes andNetworks.
5.	Working with Docker Swarm.
6.	Working with Circle CI for continuous integration.
7.	Creating Microservice with ASP.NET Core.
8.	Working with Kubernetes.
9.	Creating Backing Service with ASP.NET Core.
10.	Building real-time Microservice with ASP.NET Core.

9. Evaluation Pattern:

a. **Total Marks** : 150 Marks (10 Point Grading)

b. **Passing Criteria** : 40 % (4 Grade Points)

c. **Marking Scheme** : 60:40:50 Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)
- 50 Marks - Practical Assessment (Passing = 20 Marks)

d. **Mode of Evaluation of Answer-books** : Online/Offline

10. Paper Pattern:

a. **Internal Assessment:**

- Assessment consists of a class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
- Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination :**

Question No.	Description	Marks

1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

11. **Course Outcome:**

Upon successful completion of this course, students should be able to develop application

CO1: Develop web applications using Model View Control.

CO2: Create MVC Models and write code that implements business logic within Model methods, properties, and events.

CO3: Create Views in an MVC application that display and edit data and interact with Models and Controllers.

CO4: Boost your hire ability through innovative and independentlearning.

CO5: Gaining a thorough understanding of the philosophy and architecture of .NET Core

CO6: Implementing multi-threading effectively in .NET applications.

12. **References:**

1. Microservice Architecture: *Aligning Principles,Practices, and Culture by* Irakli Nadareishvili, Ronnie Mitra, Matt McLarty,and Mike Amundsen
2. Building Microservices withASP.NET Core by Kevin Hoffman
3. Building Microservices:Designing Fine-Grained Systems by Sam Newman
4. Production-readyMicroservices by Susan J. Fowler

COURSE STRUCTURE

1. **Title of the Course:** Image Processing
2. **Semester**: II
3. **Course Code: For Theory:** MITCC204
   For Practical: MITCCP204
4. **Course Objective:**

   This course aims to
   a. Review the fundamental concepts of a digital image processing system.
   b. Analyse images in the frequency domain using various transforms.
   c. Evaluate the techniques for image enhancement and image restoration.
   d. Categorize various compression techniques.
   e. Interpret Image compression standards.
   f. Interpret image segmentation and representation techniques.
5. **Category of Course**: Core
6. **Total Hours**: 60
7. **Total Credits**: 06 Credits (04 Credits for Theory & 02 Credits for Practical)
8. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MITCC204	Image Processing	5	3	4	2	6

Module	Detailed Content	Hours
1	Introduction: Digital Image Processing, Origins of Digital Image Processing, Applications and Examples of Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Digital Image Fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationships Between Pixels, Basic Mathematical Tools Used in Digital Image Processing, Intensity Transformations and Spatial Filtering: Basics, Basic Intensity Transformation Functions, Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing (Lowpass) Spatial Filters, Sharpening (Highpass) Spatial Filters, Highpass, Bandreject, and Bandpass Filters from Lowpass Filters, Combining Spatial Enhancement Methods, Using Fuzzy Techniques for Intensity Transformations and Spatial Filtering.	12

2	Filtering in the Frequency Domain: Background, Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform of One Variable, Extensions to Functions of Two Variables, Properties of the 2-D DFT and IDFT, Basics of Filtering in the Frequency Domain, Image Smoothing Using Lowpass Frequency Domain Filters, Image Sharpening Using Highpass Filters, Selective Filtering, Fast Fourier Transform. Image Restoration and Reconstruction: A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only-----Spatial Filtering, Periodic Noise Reduction Using Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, Geometric Mean Filter, Image Reconstruction from Projections.	12
3	Wavelet and Other Image Transforms: Preliminaries, Matrix-based Transforms, Correlation, Basis Functions in the Time-Frequency Plane, Basis Images, Fourier-Related Transforms, Walsh-Hadamard Transforms, Slant Transform, Haar Transform, Wavelet Transforms Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing, Full-Color Image Processing, Color Transformations, Color Image Smoothing and Sharpening, Using Color in Image Segmentation, Noise in Color Images, Color Image Compression. Image Compression and Watermarking: Fundamentals, Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-length Coding Symbol-based Coding, 8 Bit-plane Coding, Block Transform Coding, Predictive Coding, Wavelet Coding, Digital Image Watermarking.	12
4	Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transform, Morphological Algorithms, Morphological Reconstruction¸ Morphological Operations on Binary Images, Grayscale Morphology. Image Segmentation I: Edge Detection, Thresholding, and Region Detection: Fundamentals, Thresholding, Segmentation by Region Growing and by Region Splitting and Merging, Region Segmentation Using Clustering and Superpixels, Region Segmentation Using Graph Cuts, Segmentation Using Morphological Watersheds, Use of Motion in Segmentation.	12

5	Image Segmentation II: Active Contours: Snakes and Level Sets: Background, Image Segmentation Using Snakes, Segmentation Using Level Sets. Feature Extraction: Background, Boundary Preprocessing, Boundary Feature Descriptors, Region Feature Descriptors, Principal Components as Feature Descriptors, Whole-Image Features, Scale-Invariant Feature Transform (SIFT).	12
	Total	60

Sr. No.	**List of Practical**
1-10	10 Practical based on above syllabus, covering entire syllabus.

9. Evaluation Pattern:

a. **Total Marks:** 150 Marks (10 Point Grading)

b. **Passing Criteria**: 40 % (4 Grade Points)

c. **Marking Scheme:** 60:40:50 Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)
- 50 Marks - Practical Assessment (Passing = 20 Marks)

d. **Mode of Evaluation of Answer-books:** Online/Offline

10. Paper Pattern:

a. **Internal Assessment:**

- Assessment consists of a class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
- Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination:**

Question No.	**Description**	**Marks**
1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each.

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

11. Course Outcome:

On successful completion of this course, the Learner should be able to:

CO1: Understand the need for image transforms different types of image transforms and their properties.

CO2: Develop any image processing application.

CO3: Understand the rapid advances in Machine vision.

CO4: Learn different techniques employed for the enhancement of images.

CO5: Learn different causes for image degradation and overview of image restoration techniques.

CO6: Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.

CO7: Learn different feature extraction techniques for image analysis and recognition.

12. References:

1. Digital Image processing by R. C.Gonzalez, R.E.Woods, 3rd Edition, Pearson, 2008.
2. Fundamentals of Digital Image Processing by A.K.Jain, PHI, 1995.
3. The Image Processing Handbook by J.C. Russ, 5th Edition, CRC, 2006.
4. Digital Image Processing with MATLAB by R. C. Gonzalez & R.E. Woods, Prentice Hall, 2003.

Semester – III & IV

Semester- III		
Couse Code	**Course Code**	**Credits**
MSIT301	Technical Writing and Entrepreneurship Development	4
MSIT302	Applied Artificial Intelligence	4
MSIT303	Machine Learning	4
MSIT304	Robotic Process Automation	4
MSITP301	Technical Writing and Entrepreneurship Development Practical	2
MSITP302	Applied Artificial Intelligence Practical	2
MSITP303	Machine Learning Practical	2
MSITP304	Robotic Process Automation Practical	2
	Total	**24**

Semester- IV		
Couse Code	**Course Code**	**Credits**
MSIT401	Blockchain	4
MSIT402	Natural Language Processing	4
MSIT403	Deep Learning	4
MSIT404	Human Computer Interaction	4
MSITP401	Blockchain Practical	2
MSITP402	Natural Language Processing Practical	2
MSITP403	Deep Learning Practical	2
MSITP404	Human Computer Interaction Practical	2
	Total	**24**

COURSE STRUCTURE

1. **Title of the Course:** Technical Writing and Entrepreneurship Development
2. **Semester**: III
3. **Course Code: For Theory:** MSIT301
   For Practical: MSITP301
4. **Course Objective:**

   a) This course aims to provide conceptual understanding of developing strong foundation in general writing, including research proposal and reports.

   b) It covers the technological developing skills for writing Article, Blog, E-Book, Commercial web Page design, Business Listing Press Release, E-Listing and Product Description.

   c) This course aims to provide conceptual understanding of innovation and entrepreneurship development.

   Category of Course: Core Course

5. **Total Hours**: 60
6. **Total Credits**: 04 Credits (04 Credits for Theory)
7. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MSIT301	Technical Writing and Entrepreneurship Development	4	-	4	-	4

Module	Detailed Content	Hours
1	**Introduction to Technical Communication:** What Is Technical Communication? The Challenges of Producing Technical Communication, Characteristics of a Technical Document, Measures of Excellence in Technical Documents, Skills and Qualities Shared by Successful Workplace Communicators, How Communication Skills and Qualities Affect Your Career? **Understanding Ethical and Legal Considerations:** A Brief Introduction to Ethics, Your Ethical Obligations, Your Legal Obligations, The Role of Corporate Culture in Ethical and Legal Conduct, Understanding Ethical and Legal Issues Related to social media, Communicating Ethically Across Cultures, Principles for Ethical Communication Writing Technical	12

	Documents: Planning, Drafting, Revising, Editing, Proofreading Writing Collaboratively: Advantages and Disadvantages of Collaboration, Managing Projects, Conducting Meetings, Using social media and Other Electronic Tools in Collaboration, Importance of Word Press Website, Gender and Collaboration, Culture and Collaboration.	
2	**Introduction to Content Writing:** Types of Content (Article, Blog, E-Books, Press Release, Newsletters Etc), Exploring Content Publication Channels. Distribution of your content across various channels. **Blog Creation:** Understand the psychology behind your web traffic, Creating killing landing pages which attract users, Using Landing Page Creators, setting up Accelerated Mobile Pages, Identifying UI UX Experience of your website or blog. **Organizing Your Information:** Understanding Three Principles for Organizing Technical Information, Understanding Conventional Organizational Patterns, **Emphasizing Important Information:** Writing Clear, Informative Titles, Writing Clear, Informative Headings, Writing Clear Informative Lists, Writing Clear Informative Paragraphs.	12
3	**Creating Graphics:** The Functions of Graphics, The Characteristics of an Effective Graphic, Understanding the Process of Creating Graphics, Using Color Effectively, Choosing the Appropriate Kind of Graphic, Creating Effective Graphics for Multicultural Readers. **Researching Your Subject:** Understanding the Differences Between Academic and Workplace Research, Understanding the Research Process, Conducting Secondary Research, Conducting Primary Research, Research and Documentation: Literature Reviews, Interviewing for Information, Documenting Sources, Copyright, Paraphrasing, Questionnaires**.** **Report Components:** Abstracts, Introductions, Tables of Contents, Executive Summaries, Feasibility Reports, Investigative Reports, Laboratory Reports, Test Reports, Trip Reports, Trouble Reports.	12
4	**Writing Proposals:** Understanding the Process of Writing Proposals, The Logistics of Proposals, The "Deliverables" of Proposals, Persuasion and Proposals, Writing a Proposal, The Structure of the Proposal. Writing Informational Reports: Understanding the Process of Writing Informational Reports, Writing Directives, Writing Field Reports, Writing Progress and Status Reports, Writing Incident Reports, Writing Meeting Minutes. **Writing Recommendation Reports:** Understanding the Role of Recommendation Reports, Using a Problem-Solving Model for Preparing Recommendation Reports, Writing Recommendation Reports. Reviewing, Evaluating, and Testing	12

	Documents and Websites: Understanding Reviewing, Evaluating, and Testing, Reviewing Documents and Websites, Conducting Usability Evaluations, Conducting Usability Tests, Using Internet tools to check writing Quality, Duplicate Content Detector, What is Plagiarism?,How to avoid writing plagiarism content? **Innovation management:** an introduction: The importance of innovation, Models of innovation, Innovation as a management process. **Market adoption and technology diffusion:** Time lag between innovation and useable product, Innovation and the market, Innovation and market vision ,Analysing internet search data to help adoption and forecasting sales, Innovative new products and consumption patterns, Crowd sourcing for new product ideas, Frugal innovation and ideas from everywhere, Innovation diffusion theories.	
5	**Managing innovation within firms:** Organisations and innovation, the dilemma of innovation management, Innovation dilemma in low technology sectors, Dynamic capabilities, managing uncertainty, Managing innovation projects Operations and process innovation: Operations management, The nature of design and innovation in the context of operations, Process design, Process design and innovation. **Managing intellectual property:** Intellectual property, Trade secrets, An introduction to patents, Trademarks, Brand names, Copyright. **Management of research and development:** What is research and development?, R&D management and the industrial context, R&D investment and company success, Classifying R&D, R&D management and its link with business strategy, Strategic pressures on R&D, Which business to support and how?, Allocation of funds to R&D, Level of R&D expenditure **Managing R&D projects:** Successful technology management, The changing nature of R&D management, The acquisition of external technology, Effective R&D management, The link with the product innovation process, Evaluating R&D projects.	12
	Total	60

8. Evaluation Pattern:

a. **Total Marks** : 100 Marks (10 Point Grading)

b. **Passing Criteria** : 40 % (4 Grade Points)

c. **Marking Scheme** : 60:40: Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)

d. **Mode of Evaluation of Answer-books:** Online/Offline

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MSITP301	Project Documentation and Viva	-	4	-	2	6

The learners are expected to develop a project beyond the undergraduate level. Normal web sites, web applications, mobile apps are not expected. Preferably, the project should be from the elective chosen by the learner at the post graduate level. In semester three. The learner is supposed to prepare the synopsis and documentation. The same project has to be implemented in Semester IV.
More details about the project is given is Appendix 1.

9. Evaluation Pattern:

a. **Total Marks** : 50 Marks (10 Point Grading)
b. **Passing Criteria** : 40 % (4 Grade Points)
c. **Marking Scheme** : 50 Pattern
   - 50 Marks - Practical Assessment (Passing = 20 Marks)
d. **Mode of Evaluation of Answer-books** : Online/Offline

10. Paper Pattern:

a. **Internal Assessment:**
   - Assessment consists of a class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
   - Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination:**

Question No.	Description	Marks
1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10

6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Project + Oral	Documentation	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

11. **Course Outcome:**

After completion of the course, a student should be able to:

CO1: Develop technical documents that meet the requirements with standard guidelines. Understanding the essentials and hands-on learning about effective Website Development.

CO2:Write Better Quality Content Which Ranks faster at Search Engines. Build effective Social Media Pages.

CO3: Evaluate the essentials parameters of effective Social Media Pages.

CO4: Understand importance of innovation and entrepreneurship.

CO5: Analyze research and development projects.

12. **References:**

1. Technical Communication, By Mike Markel, 2014.
2. Innovation Management and New Product Development, By Paul Trott,2017.
3. Handbook of Technical Writing, By Gerald J. Alred, Charles T. Brusaw, Walter E. Oliu,2008.
4. Technical Writing 101: A Real-World Guide to Planning and Writing Technical Content, By Alan S. Pringle and Sarah S. O'Keefe,2009.
5. Innovation and Entrepreneurship, By Peter Drucker, 2009.

COURSE STRUCTURE

1. **Title of the Course :** Applied Artificial Intelligence
2. **Semester** : III
3. **Course Code: For Theory:** MSIT302
   For Practical: MSITP302
4. **Course Objective:**
   a. To enable the student to solve the problem aligned with derived branches of artificial intelligence.
   b. To enable the learner to understand applications of artificial intelligence.
   c. To explore the applied branches of artificial intelligence.
5. **Category of Course**: Core Course
6. **Total Hours**: 60
7. **Total Credits**: 06 Credits (04 Credits for Theory & 02 Credits for Practical)
8. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MSIT302	Applied Artificial Intelligence	4	3	4	2	6

Module	Detailed Content	Hours
1	**Review of AI:** History, foundation and Applications **Expert System and Applications:** Phases in Building Expert System, Expert System Architecture, Expert System versus Traditional Systems, Rule based Expert Systems, Blackboard Systems, Truth Maintenance System, Application of Expert Systems, Shells and Tools	12
2	**Probability Theory:** Joint probability, Conditional probability, Bayes's theorem, probabilities in rules and facts of rule based system, cumulative probabilities, rule based system and Bayesian method **Fuzzy Sets and Fuzzy Logic:** Fuzzy Sets, Fuzzy set operations, Types of Member ship Functions, Multivalued Logic, Fuzzy Logic, Linguistic variables and Hedges, Fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems, possibility theory and other enhancement to Logic	12
3	**Machine Learning Paradigms:** Machine Learning systems, supervised and un-supervised learning, inductive learning, deductive learning, clustering, support vector machines,	12

	cased based reasoning and learning. **Artificial Neural Networks:** Artificial Neural Networks, Single-Layer feed-forward networks, multi-layer feed-forward networks, radial basis function networks, design issues of artificial neural networks and recurrent networks	
4	**Evolutionary Computation:** Soft computing, genetic algorithms, genetic programming concepts, evolutionary programming, swarm intelligence, ant colony paradigm, particle swarm optimization and applications of evolutionary algorithms. **Intelligent Agents:** Agents vs software programs, classification of agents, working of an agent, single agent and multiagent systems, performance evaluation, architecture, agent communication language, applications	12
5	**Advanced Knowledge Representation Techniques:** Conceptual dependency theory, script structures, CYC theory, script structure, CYC theory, case grammars, semantic web. **Natural Language Processing:** Sentence Analysis phases, grammars and parsers, types of parsers, semantic analysis, universal networking language, dictionary	12
	Total	60

Sr. No.	List of Practical
1	Design an Expert system using AIML E.g: An expert system for responding the patient query for identifying the flu.
2	Design a bot using AIML
3	Implement Bayes Theorem using Python
4	Implement Conditional Probability and joint probability using Python
5	Write a program for to implement Rule based system
6	Design a Fuzzy based application using Python / R.
7	Write an application to simulate supervised and un-supervised learning model.
8	Write an application to implement clustering algorithm.
9	Write an application to implement support vector machine algorithm.
10	Simulate artificial neural network model with both feedforward and back-propagation approach. [You can add some functionalities to enhance the model].
11	Simulate genetic algorithm with suitable example using Python / R or any other platform.
12	Design an Artificial Intelligence application to implement intelligent agents.
13	Design an application to simulate language parser.
14	Design an application to simulate semantic web.

Evaluation Pattern:

a. **Total Marks** : 150 Marks (10 Point Grading)
b. **Passing Criteria** : 40 % (4 Grade Points)
c. **Marking Scheme** : 60:40:50 Pattern
   - 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
   - 40 Marks - Internal Assessment (Passing = 16 Marks)
   - 50 Marks - Practical Assessment (Passing = 20 Marks)
d. **Mode of Evaluation of Answer-books** : Online/Offline

9. Paper Pattern:

a. **Internal Assessment:**
   - Assessment consists of class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
   - Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination :**

Question No.	Description	Marks
1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

10. Course Outcome:

After completion of course the learner will:

CO1: be able to understand the fundamentals concepts of expert system and its applications.

CO2: be able to use probability and concept of fuzzy sets for solving AI based problems.

CO3: be able to understand the applications of Machine Learning. The learner can also apply fuzzy system for solving problems.

CO4: learner will be able to apply to understand the applications of genetic algorithms in different problems related to artificial intelligence.

CO5: A learner can use knowledge representation techniques in natural language processing.

11. **References:**

1. Artificial Intelligence: A Modern Approach A. Russel, Peter Norvig 1st Edition
2. Artificial Intelligence Saroj Kaushik Cengage 1st Edition, 2019
3. Artificial Intelligence Elaine Rich,Kevin ,Knight,Shivashankar,B. Nair ,Tata Mc-Grawhill 3rd

COURSE STRUCTURE

1. **Title of the Course :** Machine Learning
2. **Semester** : 3
3. **Course Code: For Theory:** MSIT303
   For Practical: MSITP303
4. **Course Objective:**
   a. To develop the ability to explore research techniques used for solving any real world or innovate problem.
   b. Understanding primitives in learning process by computer.
   c. Understanding nature of problems solved with Machine Learning
5. **Category of Course** : Core Course
6. **Total Hours**: 60
7. **Total Credits**: 06 Credits (04 Credits for Theory & 02 Credits for Practical)
8. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MSIT303	Machine Learning	4	3	4	2	6

Module	Detailed Content	Hours
1	**Introduction:** Machine learning, Examples of Machine Learning Problems, Structure of Learning, learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types, Feature Construction and Transformation, Feature Selection	12
2	**Classification and Regression:** Classification: Binary Classification- Assessing Classification performance, Class probability Estimation Assessing class probability Estimates, Multiclass Classification. Regression: Assessing performance of Regression- Error measures, Overfitting- Catalysts for Overfitting, Case study of Polynomial Regression. Theory of Generalization: Effective number of hypothesis, Bounding the Growth function, VC Dimensions, Regularization theory.	12
3	**Linear Models**: Least Squares method, Multivariate Linear Regression, Regularized Regression, Using Least Square regression for Classification. Perceptron, Support Vector Machines, Soft Margin SVM, Obtaining probabilities from	12

	Linear classifiers, Kernel methods for non-Linearity.	
4	**Logic Based and Algebraic Model:** Distance Based Models: Neighbours and Examples, Nearest Neighbours Classification, Distance based clustering-K means Algorithm, Hierarchical clustering, Rule Based Models: Rule learning for subgroup discovery, Association rule mining. Tree Based Models: Decision Trees, Ranking and Probability estimation Trees, Regression trees, Clustering Trees.	12
5	**Probabilistic Model:** Normal Distribution and Its Geometric Interpretations, Naïve Bayes Classifier, Discriminative learning with Maximum likelihood, Probabilistic Models with Hidden variables: Estimation-Maximization Methods, Gaussian Mixtures, and Compression based Models. **Trends In Machine Learning :** Model and SymbolsBagging and Boosting, Multitask learning, Online learning and Sequence Prediction, Data Streams and Active Learning, Deep Learning, Reinforcement Learning	12
	Total	60

Sr. No.	List of Practical
	List of Practical: 10 practicals covering the entire syllabus must be performed. The detailed list of practical will be circulated later in the official workshop

9. Evaluation Pattern:

a. **Total Marks** : 150 Marks (10 Point Grading)

b. **Passing Criteria** : 40 % (4 Grade Points)

c. **Marking Scheme** : 60:40:50 Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)
- 50 Marks - Practical Assessment (Passing = 20 Marks)

d. **Mode of Evaluation of Answer-books** : Online/Offline

10. Paper Pattern:

a. **Internal Assessment:**

- Assessment consists of a class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
- Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination :**

Question No.	Description	Marks
1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

11. Course Outcome:

Upon successful completion of this course, students should be able to:

CO1: Understand the key issues in Machine Learning and its associated applications in intelligent business and scientific computing.

CO2: Acquire the knowledge about classification and regression techniques where a learner will be able to explore his skill to generate data base knowledge using the prescribed techniques.

CO3: Understand and implement the techniques for extracting the knowledge using machine learning methods.

CO4: Achieve adequate perspectives of big data analytic in various applications like recommended systems, social media applications etc.

CO5: Understand the statistical approach related to machine learning. He will also Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

12. References:

1. Machine Learning: The Art and Science of Algorithms that Make Sense of Data by Peter Flach 2012
2. Business Analytics by Albright Winston, 5e, 2015 Introduction to Statistical Machine Learning with Applications in R by Hastie, Tibshirani, Friedman, 2012
3. Introduction to Machine Learning by Ethem Alpaydin, 2013

COURSE STRUCTURE

1. **Title of the Course:** Robotic Process Automation
2. **Semester**: III
3. **Course Code: For Theory:** MSIT304
   For Practical: MSITP304
4. **Course Objective:**
   This course aims to
   a. To make the students aware about the automation today in the industry.
   b. To make the students aware about the tools used for automation.
   c. To help the students automate a complete process.
5. **Category of Course**: Core
6. **Total Hours**: 60
7. **Total Credits**: 06 Credits (04 Credits for Theory & 02 Credits for Practical)
8. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MIT304	Robotic Process Automation	5	3	4	2	6

Module	Detailed Content	Hours
1	Robotic Process Automation: Scope and techniques of automation, About UiPath Record and Play: UiPath stack, Downloading and installing UiPath Studio, Learning UiPath Studio, Task recorder, Step-by-step examples using the recorder.	12
2	Sequence, Flowchart, and Control Flow: Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart, Step-by-step example using Sequence and Control flow Data Manipulation: Variables and scope, Collections, Arguments – Purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa (with a step-by-step example)	12
3	Taking Control of the Controls : Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping, When to use OCR, Types of OCR available, How to use OCR,	12

	Avoiding typical failure points Tame that Application with Plugins and Extensions: Terminal plugin, SAP automation, Java plugin, Citrix automation, Mail plugin, PDF plugin, Web integration, Excel and Word plugins, Credential management, Extensions – Java, Chrome, Firefox, and Silverlight	
4	Handling User Events and Assistant Bots: What are assistant bots?, Monitoring system event triggers, Hotkey trigger, Mouse trigger, System trigger ,Monitoring image and element triggers, An example of monitoring email, Example of monitoring a copying event and blocking it, Launching an assistant bot on a keyboard event Exception Handling, Debugging, and Logging: Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting	12
5	Managing and Maintaining the Code: Project organization, Nesting workflows, Reusability of workflows, Commenting techniques, State Machine, When to use Flowcharts, State Machines, or Sequences, Using config files and examples of a config file, Integrating a TFS server Deploying and Maintaining the Bot: Publishing using publish utility, Overview of Orchestration Server, Using Orchestration Server to control bots, Using Orchestration Server to deploy bots, License management, Publishing and managing updates	12
	Total	60

Sr. No.	**List of Practical**
1-10	10 Practical based on above syllabus, covering entire syllabus.

9. Evaluation Pattern:

a. **Total Marks:** 150 Marks (10 Point Grading)

b. **Passing Criteria**: 40 % (4 Grade Points)

c. **Marking Scheme:** 60:40:50 Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)
- 50 Marks - Practical Assessment (Passing = 20 Marks)

d. **Mode of Evaluation of Answer-books:** Online/Offline

10. Paper Pattern:

a. **Internal Assessment:**

- Assessment consists of a class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
- Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination:**

Question No.	Description	Marks
1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each.

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

11. Course Outcome:

On successful completion of this course, the Learner should be able to:

CO1: Understand the mechanism of business process and can provide the solution in an optimize way.

CO2: Understand the features use for interacting with database plugins.

CO3: Use the plug-ins and other controls used for process automation.

CO4: Use and handle the different events, debugging and managing the errors.

CO5: Test and deploy the automated process.

12. References:

1. Learning Robotic Process Automation, Alok Mani Tripathi, Packt, 2018
2. Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation, Srikanth Merianda, Createspace Independent Publishing, 2018
3. The Simple Implementation Guide to Robotic Process Automation (Rpa): How to Best Implement Rpa in an Organization, Kelly Wibbenmeyer, iUniverse, 2018

COURSE STRUCTURE

1. **Title of the Course:** Blockchain
2. **Semester**: IV
3. **Course Code: For Theory:** MSIT401
   For Practical: MSITP401
4. **Course Objective:**

   a) To provide conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.

   b) To cover the technological underpinnings of blockchain operations as distributed data structures and decision-making systems, their functionality and different architecture types.

   c) To provide a critical evaluation of existing "smart contract" capabilities and platforms, and examine their future directions, opportunities, risks and challenges.

   Category of Course: Core Course
5. **Total Hours**: 60
6. **Total Credits**: 08 Credits (04 Credits for Theory & 04 Credits for Practical)
7. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MSIT401	Blockchain	4	3	4	4	8

Module	Detailed Content	Hours
1	**Blockchain:** Introduction, History, centralised versus Decentralised systems, layers of blockchain, Importance of blockchain, Blockchain uses and use cases. **Working of Blockchain:** Blockchain foundation, Cryptography, Game Theory, Computer Science Engineering, Properties of blockchain solutions, blockchain transactions, distributed consensus mechanisms, Blockchain mechanisms, Scaling blockchain. **Working of Bitcoin:** Money, Bitcoin, Bitcoin blockchain, bitcoin network, bitcoin scripts, Full Nodes and SVPs, Bitcoin wallets.	12
2	**Ethereum:** three parts of blockchain, Ether as currency and commodity, building trust less systems, Smart contracts,	12

	Ethereum Virtual Machine, The Mist browser, Wallets as a Computing Metaphor, The Bank Teller Metaphor, Breaking with Banking History, How Encryption Leads to Trust, System Requirements, Using Parity with Geth, Anonymity in Cryptocurrency, Central Bank Network, Virtual Machines, EVM Applications, State Machines, Guts of the EVM, Blocks, Mining's Place in the State Transition Function, Renting Time on the EVM, Gas, Working with Gas, Accounts, Transactions, and Messages, Transactions and Messages, Estimating Gas Fees for Operations, Opcodes in the EVM. **Solidity Programming**: Introduction, Global Banking Made Real, Complementary Currency, Programming the EVM, Design Rationale, Importance of Formal Proofs, Automated Proofs, Testing, Formatting Solidity Files, Reading Code, Statements and Expressions in Solidity, Value Types, Global Special Variables, Units, and Functions.	
3	**Hyperledger:** Overview, Fabric, composer, installing hyperledger fabric and composer, deploying, running the network, error troubleshooting. **Smart Contracts and Tokens**: EVM as Back End, Assets Backed by Anything, Cryptocurrency Is a Measure of Time, Function of Collectibles in Human Systems, Platforms for High-Value Digital Collectibles, Tokens as Category of Smart Contract, Creating a Token, Deploying the Contract, Playing with Contracts.	12
4	**Mining Ether:** Why? Ether's Source, Defining Mining, Difficulty, Self-Regulation, and the Race for Profit, How Proof of Work Helps Regulate Block Time, DAG and Nonce, Faster Blocks, Stale Blocks, Difficulties, Ancestry of Blocks and Transactions, Ethereum and Bitcoin, Forking, Mining, Geth on Windows, Executing Commands in the EVM via the Geth Console, Launching Geth with Flags, Mining on the Testnet, GPU Mining Rigs, Mining on a Pool with Multiple GPUs. **Cryptoecnomics:** Introduction, Usefulness of cryptoeconomics, Speed of blocks, Ether Issuance scheme, Common Attack Scenarios.	12
5	**Blockchain Application Development:** Decentralized Applications, Blockchain Application Development, interacting with the Bitcoin Blockchain, Interacting Programmatically with Ethereum—Sending Transactions, creating a Smart Contract, Executing Smart Contract Functions, Public vs. Private Blockchains, Decentralized Application Architecture. **Building an Ethereum DApp:** The DApp, Setting Up a Private Ethereum Network, Creating the Smart Contract, Deploying the Smart Contract, Client Application. **DApp deployment:** Seven Ways to Think About Smart Contracts, Dapp Contract Data Models, EVM back-end and front-end communication, JSON-RPC, Web 3, JavaScript API,	12

	Using Meteor with the EVM, Executing Contracts in the Console, Recommendations for Prototyping, Third-Party Deployment Libraries, Creating Private Chains.	
	Total	60

Sr. No.	List of Practical
1	10 Practical as per syllabus

8. Evaluation Pattern:

a. **Total Marks** : 150 Marks (10 Point Grading)

b. **Passing Criteria** : 40 % (4 Grade Points)

c. **Marking Scheme** : 60:40:50 Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)
- 50 Marks - Practical Assessment (Passing = 20 Marks)

d. **Mode of Evaluation of Answer-books** : Online/Offline

9. Paper Pattern:

a. **Internal Assessment:**

- Assessment consists of a class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
- Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination:**

Question No.	Description	Marks
1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

10. **Course Outcome:**

After completion of the course, a student should be able to:

CO1: The students would understand the structure of a blockchain and why/when it is better than a simple distributed database.

CO2: Analyse the incentive structure in a blockchain based system and critically assess its functions, benefits and vulnerabilities.

CO3: Evaluate the setting where a blockchain based structure may be applied, its potential and its limitations.

CO4: Understand what constitutes a "smart" contract, what are its legal implications and what it can and cannot do, now and in the near future.

CO5: Develop blockchain DApps.

11. **References:**

1. Beginning Blockchain A Beginner's Guide to Building Blockchain Solutions, By Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda,2018.
2. Introducing Ethereum and Solidity, By Chris Dannen,2017.
3. The Blockchain Developer, By Elad Elrom,2019.
4. Mastering Ethereum, By Andreas M. Antonopoulos, Dr. Gavin Wood,2018.
5. Blockchain Enabled Applications, By Vikram Dhillon, David Metcalf, Max Hooper,2017.

COURSE STRUCTURE

1. **Title of the Course :** Natural Language Processing
2. **Semester** : IV
3. **Course Code: For Theory:** MSIT402
   For Practical: MITP402
4. **Course Objective:**
   a. The prime objective of this course is to introduce the students to the field of Language
   b. Computing and its applications ranging from classical era to modern context.
   c. To provide understanding of various NLP tasks and NLP abstractions such as
   d. Morphological analysis, POS tagging, concept of syntactic parsing, semantic analysis etc.
   e. To provide knowledge of different approaches/algorithms for carrying out NLP tasks.
   f. To highlight the concepts of Language grammar and grammar representation in Computational Linguistics.
5. **Category of Course**: Core Course
6. **Total Hours**: 60
7. **Total Credits**: 06 Credits (04 Credits for Theory & 02 Credits for Practical)
8. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MSIT402	Natural Language Processing	4	3	4	2	6

Module	Detailed Content	Hours
1	Introduction to NLP, brief history, NLP applications: Speech to Text(STT), Text to Speech(TTS), Story Understanding, NL Generation, Question Answering(QA) system, Machine Translation, Text Summarization, Text classification, Sentiment Analysis, Grammar/Spell Checkers etc., challenges/Open Problems, NLP abstraction levels, Natural Language (NL) Characteristics and NL computing approaches/techniques and steps, NL tasks: Segmentation, Chunking, tagging, NER, Parsing, Word Sense Disambiguation, NL Generation, Web 2.0	12

	Applications : Sentiment Analysis; Text Entailment; Cross Lingual Information Retrieval (CLIR).	
2	Text Processing Challenges, Overview of Language Scripts and their representation on Machines using Character Sets, Language, Corpus and Application Dependence issues, Segmentation: word level(Tokenization), Sentence level. Regular Expression and Automata Morphology, Types, Survey of English and Indian Languages Morphology, Morphological parsing FSA and FST, Porter stemmer, Rule based and Paradigm based Morphology, Human Morphological Processing, Machine Learning approaches.	12
3	Word Classes ad Part-of-Speech tagging(POS), survey of POS tagsets, Rule based approaches (ENGTOWL), Stochastic approaches(Probabilistic, N-gram and HMM), TBL morphology, unknown word handling, evaluation metrics: Precision/Recall/F-measure, error analysis.	12
4	NL parsing basics, approaches: TopDown, BottomUp, Overview of Grammar Formalisms: constituency and dependency school, Grammar notations CFG, LFG, PCFG, LTAG, Feature- Unification, overview of English CFG, Indian Language Parsing in Paninian Karaka Theory, CFG parsing using Earley's and CYK algorithms, Probabilistic parsing, Dependency Parsing: Covington algorithm, MALT parser, MST parser.	12
5	Concepts and issues in NL, Theories and approaches for Semantic Analysis, Meaning Representation, word similarity, Lexical Semantics, word senses and relationships, WordNet (English and IndoWordnet), Word Sense Disambiguation: Lesk Algorithm Walker's algorithm, Coreferences Resolution:Anaphora, Cataphora.	12
	Total	60

Sr. No.	**List of Practical**
1	a. Install NLTK b. Convert the given text to speech c. Convert audio file Speech to Text.
2	a. Study of various Corpus – Brown, Inaugural, Reuters, udhr with various methods like fields, raw, words, sents, categories, b. Create and use your own corpora(plaintext, categorical) c. Study Conditional frequency distributions Study of tagged corpora with methods like tagged_sents, tagged_words. d. Write a program to find the most frequent noun tags. e. Map Words to Properties Using Python Dictionaries f. Study DefaultTagger, Regular expression tagger, UnigramTagger g. Find different words from a given plain text without any space by

	comparing this text with a given corpus of words. Also find the score of words.
3	a. Study of Wordnet Dictionary with methods as synsets, definitions, examples, antonyms. b. Study lemmas, hyponyms, hypernyms, entailments, c. Write a program using python to find synonym and antonym of word "active" using Wordnet d. Compare two nouns e. Handling stopword. Using nltk Adding or Removing Stop Words in NLTK's Default Stop Word List Using Gensim Adding and Removing Stop Words in Default Gensim Stop Words List Using Spacy Adding and Removing Stop Words in Default Spacy Stop Words List
4	Text Tokenization a. Tokenization using Python's split() function b. Tokenization using Regular Expressions (RegEx) c. Tokenization using NLTK d. Tokenization using the spaCy library e. Tokenization using Keras f. Tokenization using Gensim
5	Important NLP Libraries for Indian Languages and perform: a. word tokenization in Hindi b. Generate similar sentences from a given Hindi text input c. Identify the Indian language of a text
6	Illustrate part of speech tagging. a. Part of speech Tagging and chunking of user defined text. b. Named Entity recognition of user defined text. c. Named Entity recognition with diagram using NLTK corpus – treebank
7	a. Define grammer using nltk. Analyze a sentence using the same. b. Accept the input string with Regular expression of FA: 101+ c. Accept the input string with Regular expression of FA: (a+b)*bba d. Implementation of Deductive Chart Parsing using context free grammar and a given sentence.
8	StudyPorterStemmer, LancasterStemmer, RegexpStemmer, SnowballStemmer Study WordNetLemmatizer
9	Implement Naive Bayes classifier
10	Speech Tagging: a. Speech tagging using spacy b. Speech tagging using nktl Statistical parsing: a. Usage of Give and Gave in the Penn Treebank sample b. probabilistic parser Malt parsing: Parse a sentence and draw a tree using malt parsing.
11	a. Multiword Expressions in NLP b. Normalized Web Distance and Word Similarity c. Word Sense Disambiguation

9. **Evaluation Pattern:**

a. **Total Marks** : 150 Marks (10 Point Grading)
b. **Passing Criteria** : 40 % (4 Grade Points)
c. **Marking Scheme** : 60:40:50 Pattern
   - 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
   - 40 Marks - Internal Assessment (Passing = 16 Marks)
   - 50 Marks - Practical Assessment (Passing = 20 Marks)
d. **Mode of Evaluation of Answer-books** : Online/Offline

10.**Paper Pattern:**

a. **Internal Assessment:**
   - Assessment consists of class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
   - Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination :**

Question No.	**Description**	**Marks**
1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

11. **Course Outcome:**

After completion of course the learner will:

CO1: Students will get idea about know-hows, issues and challenge in Natural Language Processing and NLP applications and their relevance in the classical and modern context.

CO2: Student will get understanding of Computational techniques and approaches for solving NLP problems and develop modules for NLP tasks and tools such as Morph Analyzer, POS tagger, Chunker, Parser, WSD tool etc.

CO3: Students will also be introduced to various grammar formalisms, which they can apply in different fields of study.

CO4: Students can take up project work or work in R&D firms working in NLP and its allied areas.

CO5: Student will be able to understand applications in different sectors

12. **References:**

1. Speech and Language Processing Martin, J. H., & Jurafsky, D. Pearson Education India 2nd 2013
2. Handbook of Natural Language Processing Indurkhya, N., & Damerau,F. J. CRC Press Taylor and Francis Group 2nd 2010
3. Natural Language Processing With Python Steven Bird, Edward Loper O'Reilly Media 2nd 2016
4. Foundations of Statistical Natural Language Processing Manning, Christopher and Heinrich, Schutze MIT Press 1st 1997.
5. Video Links: http://www.nptelvideos.in/2012/11/natural-language-processing.html

COURSE STRUCTURE

1. **Title of the Course:** Deep Learning
2. **Semester**: IV
3. **Course Code: For Theory:** MSIT403
   For Practical: MSITP403
4. **Course Objective:**
   This course aims to
   a. Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.
5. **Category of Course**: Core
6. **Total Hours**: 60
7. **Total Credits**: 06 Credits (04 Credits for Theory & 02 Credits for Practical)
8. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MSIT403	Deep Learning	5	3	4	2	6

Module	Detailed Content	Hours
1	Applied Math and Machine Learning Basics: Linear Algebra: Scalars, Vectors, Matrices and Tensors, Multiplying Matrices and Vectors , Identity and Inverse Matrices, Linear Dependence and Span , norms, special matrices and vectors, eigen decompositions. Numerical Computation: Overflow and under flow, poor conditioning, Gradient Based Optimization, Constraint optimization.	12
2	Deep Networks: Deep Feed Forward network, regularization, training deep models, dropouts, backpropagation, and optimization.	12
3	Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network. Sequence Modelling, Applications	12
4	Deep Learning Research: Linear Factor Models, Autoencoders, representation learning.	12
5	Approximate Inference, Deep Generative Models	12
	Total	60

Sr. No.	List of Practical
1-10	10 Practical based on above syllabus, covering entire syllabus.

9. Evaluation Pattern:

a. **Total Marks:** 150 Marks (10 Point Grading)

b. **Passing Criteria**: 40 % (4 Grade Points)

c. **Marking Scheme:** 60:40:50 Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)
- 50 Marks - Practical Assessment (Passing = 20 Marks)

d. **Mode of Evaluation of Answer-books:** Online/Offline

10. Paper Pattern:

a. **Internal Assessment:**

- Assessment consists of a class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.
- Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination:**

Question No.	Description	Marks
1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each.

c. **Semester End Practical Examination:**

Exam Duration (in Hours)	Practical + Oral	Journal	Total
2 Hours 30 min per batch	45 Marks	05 Marks	50 Marks

11. Course Outcome:

On successful completion of this course, the Learner should be able to:

CO1: Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.

CO2: Implement deep learning algorithms and solve real-world problems..

12. **References:**

1. Deep Learning by Ian Goodfellow, Yoshua Bengio, Aaron Courvile, 1st Edition, An MIT Press Book, 2016.
2. Fundamentals of Deep Learning by Nikhil Buduma , 1st Edition, O'Reilly, 2017.
3. Deep Learning: Methods and Applications by Deng & Yu , 1st Edition, Now Publishers, 2013.

COURSE STRUCTURE

1. **Title of the Course :** Human Computer Interaction
2. **Semester** : IV

Course Code: For Theory: MSIT404

For Practical: No Practical

3. **Course Objective:**

   a. To understand the important aspects of implementation of human-computer interfaces.
   b. To identify the various tools and techniques for interface analysis, design, and evaluation.
   c. To identify the impact of usable interfaces in the acceptance and performance utilization of information systems.

4. **Category of Course** : Core Course
5. **Total Hours**: 60
6. **Total Credits**: 06 Credits (04 Credits for Theory & 02 Credits for Practical)
7. **Modules:**

Course Code	Course Name	Teaching Scheme (Hours /Week)		Credits Assigned		
		Theory	Practical/ Tutorial	Theory	Practical/ Tutorial	Total
MSIT404	Human Computer Interaction	4	3	4	2	6

Module	Detailed Content	Hours
1	**The Interaction**: Models of interaction, Design Focus, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface,Interactivity. **Paradigms:** Introduction, Paradigms for interaction. **Interaction design basics**: What is design?, The process of design, User focus, Cultural probes, Navigation design, the big button trap, Modes, Screen design and layout, Alignment and layout matters, Checking screen colors, Iteration and prototyping. **HCI in the software process**: The software life cycle, Usability engineering , Iterative design and prototyping, Prototyping in practice, Design rationale	12
2	**Design**: Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns **Implementation support:** Elements of windowing systems, Programming the application, Going with the grain, Using	12

	toolkits, User interface management systems **Evaluation techniques**: What is evaluation?, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method	
3	**Universal design:** Universal design principles, Multi-modal interaction, Designing websites for screen readers, Choosing the right kind of speech, Designing for diversity **User support:** Requirements of user support, Approaches to user support, Adaptive help systems, Designing user support systems **Cognitive models:** Goal and task hierarchies, Linguistic models, The challenge of display-based systems, Physical and device models, Cognitive architectures	12
4	**Socio-organizational issues and stakeholder requirements:** Organizational issues, Capturing requirements **Communication and collaboration models:** Face-to-face communication, Conversation, Text-based communication, Group working **Task analysis:** Differences between task analysis and other techniques, Task decomposition, Knowledge-based analysis, Entity–relationship-based techniques, Sources of information and data collection, Uses of task analysis.	12
5	**Dialog notations and design:** What is dialog?, Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics, Dialog analysis and design **Models of the system:** Standard formalisms, Interaction models, Continuous behavior **Modeling rich interaction:** Status–event analysis, Rich contexts, Low intention and sensor-based interaction.	12
	Total	60

Sr. No.	List of Practical Project Works

8. Evaluation Pattern:

a. **Total Marks** : 150 Marks (10 Point Grading)

b. **Passing Criteria** : 40 % (4 Grade Points)

c. **Marking Scheme** : 60:40:50 Pattern

- 60 Marks - Written/Semester End Exam (Passing = 24 Marks)
- 40 Marks - Internal Assessment (Passing = 16 Marks)
- 50 Marks – Project dissertation (Passing = 20 Marks)

d. **Mode of Evaluation of Answer-books** : Online/Offline

9. Paper Pattern:

a. **Internal Assessment:**

- Assessment consists of class tests of 20 marks. The class test is to be conducted when approx. 40% syllabus is completed. Test will be of one hour.

- Students have to submit assignment after completion of each module which will carry 15 marks and 5 marks are for attendance.

b. **Semester End Theory Examination :**

Question No.	Description	Marks
1	Objectives or Short Answers (Covering All Modules)	10
2	Answer any two Questions (Descriptive based on module 1)	10
3	Answer any two Questions (Descriptive based on module 2)	10
4	Answer any two Questions (Descriptive based on module 3)	10
5	Answer any two Questions (Descriptive based on module 4)	10
6	Answer any two Questions (Descriptive based on module 5)	10

Note: Q.2 to Q.6 will include total 4 sub questions having 5 marks each

c. **Semester End Practical Examination:(Project)**

Project Implementation and Viva Voce Evaluation	Documentation Report	Implementation	Relevance of the topic	Viva Voce	Total
1 Hours 30 min per batch	20 Marks	10 Marks	10 Marks	10 Marks	50 Marks

10. Course Outcome:

Upon successful completion of this course, students should be able to:

CO1: A clear understanding of HCI principles that influence a system's interface design, before writing any code.
CO2: Understand the evaluation techniques used for any of the proposed system.
CO3 Understand the cognitive models and its design.
CO4: Able to understand how to manage the system resources and do the task analysis.
CO5: Able to design and implement a complete system.

11. References:

1. Human Computer Interaction By Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Pearson Education 3rd, 2013
2. Designing the User Interface By Shneiderman B., Plaisant C., Cohen M., Jacobs S., Pearson Education 5th, 2013