AC- / / 2021

Item No-

Rayat Shikshan Sanstha's
KARMAVEER BHAURAO PATIL COLLEGE, VASHI.
NAVI MUMBAI
(AUTONOMOUS COLLEGE)
Sector-15- A, Vashi, Navi Mumbai - 400 703

Syllabus for M.Sc. Information Technology–Part I

Program: M.Sc. Information Technology

Course: M.Sc. Information Technology

(Choice Based Credit, Grading and Semester System with effect from the academic year 2021-2022)

AC_____

Item No._____

Rayat Shikshan Sanstha's

KARMAVEER BHAURAO PATIL COLLEGE, VASHI, NAVI MUMBAI

		Syllabus for Approval
Sr.No.	**Heading**	**Particulars**
1.	Title of the Course	M.Sc. Information Technology
2.	Eligibility for Admission	Degree with 12th Mathematics
3.	Passing Marks	40%
4.	Regulations (if any) / Ordinances/	
5.	No. of Years/ Semesters	04 Semester / 02 year
6.	Level	P.G.
7.	Pattern	Semester
8.	Status	New

To be implemented

9.	from Academic Year	From Academic Year : 2021-2022

Date: Signature:

Name of BOS Chairperson / Dean : _____

Preamble of the Syllabus:

The subject of Information Technology is one of the important application tool which can be applied to different areas in teaching, training and learning which is considered to be important in terms of human resource development, Information Processing and Decision Making which enhances the development of a Nation.

Information Technology as an application science is studied to be applied for other areas, right from Mathematics to other basic sciences, applied sciences, social sciences and each and every aspect of human life.

The main aim of the course is to focus on the technological tools and concepts available and how they can be applied to the developmental processes

The various concepts include Embedded System, Information Security Management, Virtualization, Ethical Hacking, Artificial Intelligence, IT Infrastructure Management, Computer Forensics, Cloud Management, Project and so on..

Information Technology Experts are very much required right from academic institutions, Research and Development to Industries both Public and Private Sectors. The two year programme of M.Sc. (Information Technology) is prescribed according to the credit system of University of Mumbai from the academic year 2020-21. The course has been divided in to four semesters. The programme has a total 16 theory papers, and four in each semester.

The programme is designed to provide students a focused elaborate training in Information Technology concepts and tools as well as exposing them to the advanced fields. In addition to theoretical knowledge, significant emphasis has been given to provide hands on experience to the students in the frontier areas of Information Technology. A multidisciplinary approach has been employed to provide best leverage to students to enable.

Syllabus for M.Sc. Part-1 Information Technology

Objectives of the Course:

A few years after graduation, students with a M.Sc in Information Technology will be able to::

- Prepare highly qualified specialists for the Saudi industry in the field of information technology.
- Develop interpersonal skills, teamwork skills, leadership skills, and project management skills.
- Learn how to operate a professional IT practice
- Study a broad context of advanced contemporary IT issues

Course Outcome:

By the end of the course, a student should develop the ability:

Upon graduation, students with a M.Sc in Information Technology will be able to:

- Students will develop ability to use IT skills in decision making, by analyzing problems, developing solutions and explaining findings.
- Students can recognize ethical and professional responsibilities in IT.
- Students can design an IT solution using best practices and standard methodologies in the field.
- Student can easily implement, and test an IT solution, and evaluate its effectiveness.
- Student can use and apply current technical concepts and practices in the core information technologies of networking, data management, software engineering, computer security.
- Student can demonstrate a deep understanding of the IT methodologies and frameworks used to solve complex computing problems related to at least one IT Body-of-Knowledge
- Student will build the ability to identify and analyze user needs and take them into account in the selection, creation, evaluation and administration of computer-based systems.
- Student can effectively integrate IT-based solutions into the user environment.

- Student will developed and implement optimal solutions to complex computing problems using industry-recognized best practices and standards.
- Student can apply ethical decision making in the development, implementation, and management of IT systems.

Scheme of examination for Each Semester:

Continuous Internal Evaluation: 40 Marks (40 Marks for- Assignment, Projects, Open book test, Presentation, Seminar/Workshop, Research Paper Writing, NPTEL/ Swayam Online Courses, Teaching Assistance, Social Responsibility Activity etc.)

Semester End Examination: 60 Marks will be as follows -

<table>
<tr><td rowspan="7">I.</td><td colspan="2">Theory: The Semester End Examination for theory course work will be conducted as per the following scheme.</td></tr>
<tr><td colspan="2">Each theory paper shall be of two and half hour duration.</td></tr>
<tr><td colspan="2">All questions are compulsory and will have internal options.</td></tr>
<tr><td>Q – I</td><td>From Unit – I (having internal options.) 12 M</td></tr>
<tr><td>Q – II</td><td>From Unit – II (having internal options.) 12 M</td></tr>
<tr><td>Q – III</td><td>From Unit – III (having internal options.) 12 M</td></tr>
<tr><td>Q – IV</td><td>From Unit – IV (having internal options.) 12 M</td></tr>
<tr><td></td><td>Q - V</td><td>From Unit – V (having internal options.) 12 M</td></tr>
<tr><td>II.</td><td>Practical</td><td>The Semester End Examination for practical course work will be conducted as per the following scheme.</td></tr>
</table>

Sr. No.	**Particulars of Semester End Practical Examination**	**Marks%**
1	Laboratory Work	40
2	Journal	05
3	Viva	05
	TOTAL	**50**

Credit and Workload Calculation M.Sc Information Technology Program as per CBCS pattern

Sem	Course Type	Course Code	Course Name	Credit	Semester Wise Credit	Workload (TH + PR)	Semester wise Workload (TH + PR)
I	CORE COURSE	PGIT101	Big Data Analytics	6	28	4+4	19+18 =37
	CORE COURSE	PGIT102	Data Science	6		4+4	
	CORE COURSE	PGIT103	Cloud Computing	6		4+4	
	Skill Enhancement Course (SEC)	PGIT104	Soft Computing Techniques OR Advanced Python Programming (other department)	4		3+2	
	Elective: Discipline Specific (DSE)	PGIT105A PGIT105B	Ethical Hacking **OR** Image Processing	6		4+4	
II	CORE COURSE	PGIT201	Research in Computing	6	28	4+4	19+18=37
	CORE COURSE	PGIT202	Microservices Architecture	6		4+4	
	CORE COURSE	PGIT203	Modern Networking	6		4+4	
	Skill Enhancement Course (SEC)	PGIT204	Applied Artificial Intelligence	4		3+2	
	Elective: Discipline Specific (DSE)	PGIT205A PGIT205B	Computer Forensic **OR** Computer Vision	6		4+4	
III	CORE COURSE	PGIT301	Technical Writing and Entrepreneurship Development	6	28	4+4	15+14=29
	CORE COURSE	PGIT302	Machine Learning	6		4+4	
	Skill Enhancement Course (SEC)	PGIT303	Advanced IoT	4		3+2	
	Elective: Discipline Specific (DSE)	PGIT304A PGIT304B	Malware Analysis **OR** Robotic Process Automation	6		4+4	
	Other	PGIT305	Internship	6		---	
IV	CORE COURSE	PGIT401	Blockchain	6	28	4+4	19+18=37
	CORE COURSE	PGIT402	Deep Learning	6		4+4	

	Skill Enhancement Course (SEC)	PGIT403	Natural Language Processing	4		3+2	
	Elective: Discipline Specific (DSE)	PGIT404A PGIT404B	Human Computer Interaction **OR** Virtual Reality and Augmented Reality	6		4+4	
	Other	PGIT405	Project	6		4+4	
				112	**112**	72+68	**140**

Semester – I		
Course Code	**Course Title**	**Credits**
PGIT101	Big Data Analytics	4
PGIT102	Data Science	4
PGIT103	Cloud Computing	4
PGIT104	Soft Computing Techniques	3
PGIT105A	Ethical Hacking	4
PGIT105B	Image Processing	4
PGIT1P1	Big Data Analytics Practical	2
PGIT1P2	Data Science Practical	2
PGIT1P3	Cloud Computing Practical	2
PGIT1P4	Soft Computing Techniques Practical	1
PGIT1P5A	Ethical Hacking Practical	2
PGIT1P5B	Image Processing Practical	2
	Total Credits	**28**

Semester – II		
Course Code	**Course Title**	**Credits**
PGIT201	Research in Computing	4
PGIT202	Microservices Architecture	4
PGIT203	Modern Networking	4
PGIT204	Applied Artificial Intelligence	3
PGIT205A	Computer Forensic	4
PGIT205B	Computer Vision	4
PGIT2P1	Research in Computing Practical	2
PGIT2P2	Microservices Architecture Practical	2
PGIT2P3	Modern Networking Practical	2

PGIT2P4	Applied Artificial Intelligence Practical	1
PGIT2P5A	Computer Forensic Practical	2
PGIT2P5B	Computer Vision Practical	2
	Total Credits	**28**

SEMESTER I

M. Sc (Information Technology)		**Semester – I**	
Course Name : Big Data Analytics		**Course Code: PGIT101**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**60**
	Theory Internal	**--**	**40**

Objectives

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

Expected Learning Outcomes:

- Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
- Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
- Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
- Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

Unit	Details	Lectures

I	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 LifeCycle	**12**
II	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**
III	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**
IV	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,WorkingwithDistributedComputation,FrameworkforPython 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**
V	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 RelationaldatawithSqoop,Injestingstreamdatawithflume.Analytics with higher level APIs, Pig, Spark's higher levelAPIs.	**12**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Big Data and Analytics	Subhashini ChellappanSeemaAcharya	Wiley	First	
2.	Data Analytics with Hadoop *An Introduction for Data Scientists*	*Benjamin Bengfort and Jenny Kim*	O'Reilly		2016
3.	Big Data and Hadoop	V.K Jain	Khanna Publishing	First	2018

M. Sc (Information Technology)		Semester – I	
Course Name : BigData Analytics Practical		**Course Code: PGIT1P1**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**40**

Practical No	Details
1	Install, configure and run Hadoop and HDFS ad explore HDFS.
2	Implement word count / frequency programs using MapReduce
3	Implement an MapReduce program that processes a weather dataset.
4	Implement an application that stores big data in Hbase / MongoDB and manipulate it using R / Python
5	Implement the program in practical 4 using Pig.
6	Configure the Hive and implement the application in Hive.
7	Write a program to illustrate the working of Jaql.
8	Implement the following:
a.	Implement Decision tree classification techniques
b.	Implement SVM classification techniques
9	Solve the following:
a.	REGRESSION MODEL Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in an institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. require (foreign), require(MASS).
b.	MULTIPLE REGRESSION MODEL Apply multiple regressions, if data have a continuous independent variable. Apply on above dataset.

10	Solve the Following:
a.	CLASSIFICATION MODEL a. Install relevant package for classification. b. Choose classifier for classification problem. c. Evaluate the performance of classifier.
b.	CLUSTERING MODEL a. Clustering algorithms for unsupervised classification. b. Plot the cluster data using R visualizations.

M. Sc (Information Technology)		**Semester – I**	
Course Name : Data Science		**Course Code: PGIT102**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**60**
	Theory Internal	**--**	**40**

Objectives:

- Developindepthunderstandingofthekeytechnologiesindatascience and business analytics: data mining, machine learning, visualization techniques, predictive modelling, andstatistics.
- Practice problem analysis and decision-making.
- Gain practical, hands-on experience with statistics programming languages and big data tools through coursework and applied research experiences.

Expected Learning Outcomes:

A learner will be able to:

- Apply quantitative modeling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualizationtechniques.
- Recognize and analyze ethical issues in business related to intellectual property, data

security, integrity, andprivacy.

- Apply ethical practices in everyday business activities and make well- reasoned ethical business and data managementdecisions.
- Demonstrate knowledge of statistical data analysis techniques utilized in business decisionmaking.
- Apply principles of Data Science to the analysis of businessproblems.
- Use data mining software to solve real-worldproblems.
- Employ cutting edge tools and technologies to analyze BigData.
- Apply algorithms to build machineintelligence.
- Demonstrate use of team work, leadership skills, decision making and organizationtheory.

Unit	Details	Lectures
I	**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,ElasticSearch,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 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	**12**
II	**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**
III	**Assess Superstep:** Assess Superstep, Errors, Analysis of Data, Practical Actions, Engineering a Practical Assess Superstep,	**12**
IV	**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**
V	**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	**12**

	Learning, Bagging Data,Random Forests, Computer Vision (CV) , Natural Language Processing (NLP), Neural Networks, TensorFlow. **Organize and Report Supersteps :** Organize Superstep, Report Superstep, Graphics, Pictures, Showing the Difference	

Books and References:

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Practical Data Science	Andreas François Vermeulen	APress		2018
2.	Principles of Data Science	SinanOzdemir	PACKT		2016
3.	Data Science from Scratch	Joel Grus	O'Reilly		2015
4.	Data Science from Scratch first Principle in python	Joel Grus	Shroff Publishers		2017
5.	Experimental Design in Data science with Least Resources	N C Das	Shroff Publishers		2018

M. Sc (Information Technology)		**Semester – I**	
Course Name: Data Science Practical		**Course Code: PGIT1P2**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**40**

Practical No		**Details**
1		**Creating Data Model using Cassandra.**
2		**Conversion from different formats to HOURS format.**
	A	Text delimited csv format.
	B	XML
	C	JSON
	D	My SQL Database
	E	Pic ture (JPEG)
	F	Vid eo
	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**

M. Sc (Information Technology)		**Semester – I**	
Course Name: Cloud Computing		**Course Code: PGIT103**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**60**
	Theory Internal	**--**	**40**

Objectives:

- To learn how to use Cloud Services. To implement Virtualization.
- To implement Task Scheduling algorithms. Apply Map-Reduce concept to applications. To build Private Cloud.
- Broadly educate to know the impact of engineering on legal and societal issues involved.

Expected Learning Outcomes:

A learner will be able to:

- Analyze the Cloud computing setup with its vulnerabilities and applications using differentarchitectures.

- Design different workflows according to requirements and apply map reduce programmingmodel.
- Apply and design suitable Virtualization concept, Cloud Resource Management and design schedulingalgorithms.
- Create combinatorial auctions for cloud resources and design scheduling algorithms for computingclouds
- Assess cloud Storage systems and Cloud security, the risks involved, its impact and develop cloudapplication
- Broadly educate to know the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing.

Unit	Details	Lectures
I	**Introduction to Cloud Computing:** Introduction, Historical developments,BuildingCloudComputingEnvironments,**Principlesof ParallelandDistributedComputing:**ErasofComputing,Parallelv/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.LogicalNetworkPerimeter,VirtualServer,CloudStorage Device, Cloud usage monitor, Resource replication, Ready-made environment.	**12**
II	**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 security threats, additional considerations. **Industrial Platforms and New Developments:** Amazon Web Services, Google App Engine, Microsoft Azure.	**12**
III	**Specialized Cloud Mechanisms:** Automated Scaling listener, Load Balancer, SLA monitor, Pay-per-use monitor, Audit monitor, fail over system, Hypervisor, Resource Centre, Multidevice 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 Sign-On (SSO), Cloud-Based Security Groups, Hardened Virtual Server Images	**12**
IV	**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 StorageArchitecture. **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-MetalProvisioning Architecture, Rapid Provisioning Architecture, StorageWorkload ManagementArchitecture	**12**
V	**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**

Books and References:

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Mastering Cloud Computing Foundations and ApplicationsProgramming	RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi	Elsevier	-	2013
2.	Cloud Computing Concepts, Technology & Architecture	Thomas Erl, ZaighamMahmood, and Ricardo Puttini	Prentice Hall	-	2013
3.	Distributed and Cloud Computing, FromParallel Processing to the Internet of Things	Kai Hwang, Jack Dongarra, Geoffrey Fox	MK Publishers	--	2012

M. Sc (Information Technology)		Semester – I	
Course Name: Cloud Computing Practical		Course Code: PGIT1P3	
Periods per week 1 Period is 60 minutes	Lectures	4	
	Credits	2	
		Hours	Marks
Evaluation System	Practical Examination	2	40

Practical No		Details
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	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 VMWareESXi Server and managing withvCenter
8		Implement Windows Hyper V virtualization

9		Develop application for Microsoft Azure.
10		Develop application for Google App Engine

M. Sc (Information Technology)		**Semester – I**	
Course Name: Soft Computing Techniques		**Course Code: PGIT104**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**3**	
	Credits	**3**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**60**
	Theory Internal	**--**	**40**

Objectives:

- Soft computing concepts like fuzzy logic, neural networks and geneticalgorithm, where Artificial Intelligence is mother branch of all.
- All these techniques will be more effective to solve the problemefficiently.

Expected Learning Outcomes:

A learner will be able to:

- Identify and describe soft computing techniques and their roles inbuilding intelligent machines
- Recognize the feasibility of applying a soft computing methodology for a particular problem
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems
- Apply genetic algorithms to combinatorial optimization problems
- Apply neural networks for classification and regression problems
- Effectively use existing software tools to solve real problems using a soft computing approach
- Evaluate and compare solutions by various soft computing approaches for a given problem.

Unit	Details	Lectures
I	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**
II	**Artificial Neural Network:** Fundamental concept, Evolution of Neural	**12**

	Networks, Basic Models, McCulloh-Pitts Neuron, Linear Separability,Hebb Network. **Supervised Learning Network:** Perceptron Networks, Adaptive LinearNeuron, Multiple Adaptive Linear Neurons, BackpropagationNetwork,Radial Basis Function, Time Delay Network, Functional Link Networks,Tree Neural Network. **Associative Memory Networks:** Training algorithm for pattern Association, Autoassociative memory network, hetroassociative memory network, bi-directional associative memory, Hopfield networks, iterative autoassociative memory networks, temporal associative memory networks.	
III	**UnSupervised Learning Networks:** Fixed weight competitive nets, Kohonen self-organizing feature maps, learning vectors quantization, counterpropogation networks, adaptive resonance theory networks. Special Networks: Simulated annealing, Boltzman machine, Gaussian Machine, Cauchy Machine, Probabilistic neural net, cascade correlationnetwork, cognition network, neo-cognition network, cellular neuralnetwork, optical neural network **Third Generation Neural Networks:**Spiking Neural networks, convolutional neural networks, deep learningneural networks, extreme learning machine model.	**12**
IV	**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**
V	**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 geneticalgorithm, general genetic algorithm, operators in genetic algorithm,stopping condition for genetic algorithm flow, constraints in geneticalgorithm, problem solving using genetic algorithm, the schematheorem, classification of genetic algorithm, Holland classifier systems,genetic programming, advantages and limitations and applications ofgeneticalgorithm.Differential Evolution Algorithm, Hybrid soft computing techniques –neuro – fuzzy hybrid, genetic neuro-hybrid systems, genetic fuzzyhybrid and fuzzy genetic hybrid systems.	**12**

Books and References:

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Artificial Intelligence and Soft Computing	AnanditaDasBattacharya	SPD	3rd	2018
2.	Principles of Soft computing	S.N.Sivanandam S.N.Deepa	Wiley	3rd	2019
3.	Neuro-FuzzyandSoftComputing	J.S.R.Jang, C.T.Sun and E.Mizutani	Prentice Hall of India		2004
4.	Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications	S.Rajasekaran, G. A. Vijayalakshami	Prentice Hall of India		2004
5.	Fuzzy Logic with Engineering Applications	Timothy J.Ross	McGraw-Hill		1997
6.	Genetic Algorithms: Search, Optimization and Machine Learning	Davis E.Goldberg	Addison Wesley		1989
7.	Introduction to AI and Expert System	Dan W. Patterson	Prentice Hall of India		2009

M. Sc (Information Technology)		Semester – I	
Course Name: Soft Computing Practicals		**Course Code: PGIT1P4**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**2**	
	Credits	**1**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**40**

Practical No		Details
1		Implement the following:
	a	Design a simple linear neural network model.
	b	Calculate the output of neural net using both binary and bipolar sigmoidal function.
2		Implement the following:
	a	Generate AND/NOT function using McCulloch-Pitts neural net.
	b	Generate XOR function using McCulloch-Pitts neural net.
3		Implement the Following
	a	Write a program to implement Hebb's rule.
	b	Write a program to implement of delta rule.
4.		Implement the Following
	a	Write a program for Back Propagation Algorithm
	b	Write a program for error Backpropagation algorithm.
5.		Implement the Following
	a	Write a program for Hopfield Network.
	b	Write a program for Radial Basis function
6.		Implement the Following
	a	Kohonen Self organizing map
	b	Adaptive resonance theory
7.		Implement the Following
	a	Write a program for Linear separation.
	b	Write a program for Hopfield network model for associative memory
8.		Implement the Following
	a	Membership and Identity Operators | in, not in,
	b.	Membership and Identity Operatorsis, is not
9.		Implement the Following
	a	Find ratios using fuzzy logic
	b	Solve Tipping problem using fuzzy logic
10.		Implement the Following
	a	Implementation of Simple genetic algorithm
	b	Create two classes: City and Fitness using Genetic algorithm

M. Sc (Information Technology)		Semester – I	
Course Name: Ethical Hacking		**Course Code: PGIT105A**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**60**
	Theory Internal	**--**	**40**

Objective:

The course objective is to help prepare learners for the Certified Ethical Hacker certification exam.

Learning Outcomes:

- Identify footprinting techniques and tools
- Recognize the characteristics of the enumeration phase of an attack and effective countermeasures
- Determine the techniques and tools used in system hacking
- Describe the characteristics of trojans, worms, and malware
- Differentiate between ARP attack tools and countermeasures
- Sequence the steps you would perform to complete a penetration test on your web servers
- Determine what you test for at which stage of web application penetration
- Determine how to counter wireless network hacking techniques
- Identify tools and techniques used to evade IDS, firewalls, and honeypots

Unit	Details	Lectures
Unit-I	Introduction to Ethical Hacking, Footprinting and Reconnaissance, Scanning Networks, Enumeration	**12**
Unit-II	System Hacking, Trojans and Backdoors, Viruses and Worms, Sniffing	**12**
Unit-III	Social Engineering, Denial of Service, Session Hijacking, Hacking Webservers	**12**
Unit-IV	Hacking Web Applications, SQL Injection, Hacking Wireless Networks, Hacking Mobile Platforms	**12**

Unit-V	Evading IDS, Firewalls and Honeypots, Buffer Overflows, Cryptography, Penetration Testing	**12**

Books / References

Title	Author/s	Edition	Publisher
Ethical Hacking Review Guide	Kimberly Graves		**Wiley Publishing**
Ethical Hacking	AnkitFadia	2nd Edition	Macmillan India Ltd, 2006
Insider Computer Fraud	Kenneth C.Brancik	2008	Auerbach Publications Taylor & Francis Group

M. Sc (Information Technology)		Semester – I	
Course Name: Ethical Hacking Practical		**Course Code: PGIT1P5A**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**40**

List of Practicals

1. Using the tools for whois, traceroute, email tracking, google hacking.
2. Using the tools for scanning network, IP fragmentation, war dialing countermeasures, SSL Proxy, Censorship circumvention.
3. Using NETBIOS Enumeration tool, SNMP Enumeration tool, LINUX/ UNIX.enumeration tools, NTP Enumeration tool, DNS analyzing and enumeration tool.
4. Using System Hacking tools.
5. Study of backdoors and Trojan tools
6. Study of sniffing tools
7. Study of Denial of Service attack tools
8. Study of Hijacking tools
9. Study of webserver attack tools.
10. Study of SQL injection and Web server tools
11. Study of wireless hacking tools
12. Using cryptanalysis tool.
13. Study of different security tools.

M. Sc (Information Technology)		Semester – I	
Course Name: Image Processing		**Course Code: PGIT105B**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**60**
	Theory Internal	**--**	**40**

Objectives

- Review the fundamental concepts of a digital image processing system.
- Analyze images in the frequency domain using various transforms.
- Evaluate the techniques for image enhancement and image restoration.
- Categorize various compression techniques.
- Interpret Image compression standards.
- Interpret image segmentation and representation techniques.

Expected Learning Outcomes:

- Understand the relevant aspects of digital image representation and their practical implications.
- Have the ability to design pointwise intensity transformations to meet stated specifications.
- Understand 2-D convolution, the 2-D DFT, and have the abitilty to design systems using these concepts.
- Have a command of basic image restoration techniques.
- Understand the role of alternative color spaces, and the design requirements leading to choices of color space.
- Appreciate the utility of wavelet decompositions and their role in image processing systems.
- Have an understanding of the underlying mechanisms of image compression, and the ability to design systems using standard algorithms to meet design specifications.

Unit	Details	Lectures
I	**Introduction:**DigitalImageProcessing,OriginsofDigitalImageProcessing, 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)SpatialFilters,Highpass,Bandreject,andBandpassFiltersfromLowpass Filters, Combining Spatial Enhancement Methods, UsingFuzzy Techniques for Intensity Transformations and SpatialFiltering	**12**

II	**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**
III	**Wavelet and Other Image Transforms:** Preliminaries, Matrix-based Transforms, Correlation, Basis Functions in the Time-Frequency Plane, BasisImages, 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, ColorImageSmoothingandSharpening,UsingColorinImageSegmentation, Noise in Color Images, Color ImageCompression. **Image Compression and Watermarking:** Fundamentals, Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-length Coding, Symbol-based Coding, 8 Bit-plane Coding, Block TransformCoding, Predictive Coding, Wavelet Coding, Digital ImageWatermarking,	**12**
IV	**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**
V	**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**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Digital Image Processing	Gonzalez and Woods	Pearson/Prentice Hall	Fourth	2018
2.	Fundamentals of Digital Image Processing	A K. Jain	PHI		
3.	The Image Processing Handbook	J. C. Russ	CRC	Fifth	2010

Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**40**

List of Practical

All practicals can be done in MATLAB / Scilab / Python
Note:

1) Use of built-in functions for matrix operations and mathematical operations are allowed
2) Use gray-level and color images or image matrices as input to all programs.

I		Basics
1	**a**	Program to calculate number of samples required for an image.
	b	Program to study the effects of reducing the spatial resolution of a digital image.
	c	Program to study the effects of varying the number of intensity levels in a digital image
	d	Program to perform image averaging (image addition) for noise reduction.
	e	Program to compare images using subtraction for enhancing the difference between images.
	f.	Image Registration.
	2.	Intensity transformation and Spatial Filtering
		IMAGE ENHANCEMENT
	A	Basic Intensity Transformation functions
		i. Program to perform Image negation ii. Program to perform threshold on an image. iii. Program to perform Log transformation iv. Power-law transformations v. Piecewise linear transformations a. Contrast Stretching b. Gray-level slicing with and without background. c. Bit-plane slicing
	B	1. Program to plot the histogram of an image and categorise 2. Program to apply histogram equalization
	C	Write a program to perform convolution and correlation
	D	Write a program to apply smoothing and sharpening filters on grayscale and color images a) Low Pass b) High Pass Note: Use all kernels mentioned in the reference book
3.		Filtering in Frequency Domain

	a) Program to apply Discrete Fourier Transform on an image
	b) Program to apply Low pass and High pass filters in frequency domain
	c) Program to apply Laplacian filter in frequency domain
	d) Note: All other filters can be applied, studied and compared with filters in spatial domain.
	e) Program for high frequency emphasis filtering, high boost and homomorphic filtering.
4.	Image Denoising
	i. Program to denoise using spatial mean, median and adaptive mean filtering
	ii. Program for Image deblurring using inverse, Weiner filters
5.	Color Image Processing
	i. Program to read a color image and segment into RGB planes , histogram of color image
	ii. Program for converting from one color model to another model
	iii. Program to apply false colouring(pseudo) on a gray scale image
6.	Fourier Related Transforms
	Program to compute Discrete Cosine Transforms, Walsh -Hadamard Transforms, Haar Transform , Wavelet
7.	Image compression
	Program to apply compression and decompression algorithm on an image (Arithmetic, Huffman and LZW coding techniques.
8.	Morphological Image Processing
	i. Program to apply erosion, dilation, opening, closing
	ii. Program for detecting boundary of an image
	iii. Program to apply Hit-or-Miss transform
	iv. Program to apply morphological gradient on an image
	v. Program to apply Top-Hat/Bottom-hat Transformations
9.	Image Segmentation
	i. Program for Edge detection using a. Sobel, Prewitt, Marr-Hildreth and Canny
	ii. Illustrate Watershed segmentation algorithm
	iii. Any more to be included(to be consulted)
10.	Feature Extraction
	i. Apply Principal components for image description
	ii. Apply Harris-Stephens corner detector algorithm

SEMESTER II

M. Sc (Information Technology)		Semester – II	
Course Name: Research in Computing		Course Code: PGIT201	
Periods per week 1 Period is 60 minutes	Lectures	4	
	Credits	4	
		Hours	Marks
Evaluation System	Theory Examination	2½	60
	Theory Internal	--	40

Objectives:

- To be able to conduct business research with an understanding of all the latest theories.
- To develop the ability to explore research techniques used for solving any real world or innovate problem.

Expected Learning Outcomes:

A learner will be able to:

- solve real world problems with scientific approach. develop analytical skills by applying scientific methods.
- recognize, understand and apply the language, theory and models of the field of business analytics
- foster an ability to critically analyze, synthesize and solve complex unstructured business problems
- understand and critically apply the concepts and methods of business analytics
- identify, model and solve decision problems in different settings interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity
- create viable solutions to decision making problems

Unit	Details	Lectures
I	**Introduction:** Role of Business Research, Information Systems and Knowledge Management, Theory Building, Organization ethics and Issues	12
II	**Beginning Stages of Research Process:**Problemdefinition, Qualitative research tools, Secondary data research	12

III	**Research Methods and Data Collection:** Survey research, communicating with respondents, Observation methods, Experimental research	**12**
IV	**Measurement Concepts, Sampling and Field work:** Levels of Scale measurement, attitude measurement, questionnaire design, sampling designs and procedures, determination of sample size	**12**
V	**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**

Books and References:

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Business Research Methods	William G.Zikmund, B.J Babin, J.C. Carr,AtanuAdhikari, M.Griffin	Cengage	8e	2016
2.	Business Analytics	Albright Winston	Cengage	5e	2015
3.	Research Methods for Business Students Fifth Edition	Mark Saunders			2011
4.	Multivariate Data Analysis	Hair	Pearson	7e	2014

M. Sc (Information Technology)		Semester – II	
Course Name: Research in Computing Practical		**Course Code: PGIT2P1**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**40**

Practical No		Details
1	A	Write a program for obtaining descriptive statistics of data.
	B	Import data from different data sources (from Excel, csv, mysql, sql server, oracle to R/Python/Excel)
2	A	Design a survey form for a given case study, collectthe primary data and analyze it
	B	Perform suitable analysis of given secondary data.
3	A	Perform testing of hypothesis using one sample t-test.
	B	Perform testing of hypothesis using two sample t-test.
	C	Perform testing of hypothesis using paired t-test.
4	A	Perform testing of hypothesis using chi-squared goodness-of-fit test.
	B	Perform testing of hypothesis using chi-squared Test of Independence
5		Perform testing of hypothesis using Z-test.
6	A	Perform testing of hypothesis using one-way ANOVA.
	B	Perform testing of hypothesis using two-way ANOVA.
	C	Perform testing of hypothesis using multivariate ANOVA (MANOVA).
7	A	Perform the Random sampling for the given data and analyse it.
	B	Perform the Stratified sampling for the given data and analyse it.
8		Compute different types of correlation.
9	A	Perform linear regression for prediction.
	B	Perform polynomial regression for prediction.
10	A	Perform multiple linear regression.
	B	Perform Logistic regression.

M. Sc (Information Technology)		Semester – II	
Course Name: Microservice Architecture		**Course Code: PGIT202**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**60**
	Theory Internal	**--**	**40**

Objectives:

- Gain a thorough understanding of the philosophy and architecture of Web applications using ASP.NET Core MVC;
- Gain a practical understanding of.NET Core;
- Acquire a working knowledge of Web application development using ASP.NET Core MVC 6 and Visual Studio
- Persist data with XML Serialization and ADO.NET with SQL Server Create HTTP services using ASP.NET Core Web API;
- Deploy ASP.NET Core MVC applications to the Windows Azurecloud.

Expected Learning Outcomes:

- Develop web applications using Model View Control.
- Create MVC Models and write code that implements business logic within Model methods, properties, and events.
- Create Views in an MVC application that display and edit data and interact with Models and Controllers.
- Boost your hire ability through innovative and independent learning.
- Gainingathorough understanding of the philosophy and architecture of .NET Core
- Understanding packages, metapackages and frameworks Acquiring a working knowledge of the .NET programming model Implementing multi-threading effectively in .NET applications

Unit	Details	Lectures

I	**Microservices:** Understanding Microservices, Adopting Microservices, The Microservices Way. **Microservices Value Proposition:** Deriving Business Value, defining a Goal-Oriented, Layered Approach, Applying the Goal-Oriented, Layered Approach. **Designing Microservice Systems:** The Systems Approach to Microservices, A Microservices Design Process, **Establishing a Foundation:** Goals and Principles, Platforms, Culture.	**12**
II	**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 and Operations:** Independent Deployability, More Servers, Docker and Microservices, Role of Service Discovery, Need foran API Gateway, Monitoring and Alerting. **Adopting Micro services in Practice:** Solution Architecture Guidance, Organizational Guidance, Culture Guidance, Tools and Process Guidance, Services Guidance.	**12**
III	**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 with Circle 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, Enhancing Team Service.	**12**
IV	**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 Supported Discovery.	**12**
V	**Configuring Microservice Ecosystems:** Using Environment Variables with Docker, Using Spring Cloud Config Server, Configuring Microservices with etc, **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, Web sockets 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**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Microservice Architecture: *Aligning Principles, Practices, andCulture*	IrakliNadareishvili, Ronnie Mitra, Matt McLarty, and Mike Amundsen	O'Reilly	First	2016
2.	Building Microservices with ASP.NET Core	Kevin Hoffman	O'Reilly	First	2017
3.	Building Microservices: Designing Fine-Grained Systems	Sam Newman	O'Reilly	First	
4.	Production-ready Microservices	Susan J. Fowler	O'Reilly		2016

M. Sc (Information Technology)		**Semester – II**	
Course Name: Microservices Architecture Practical		**Course Code: PGIT2P2**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**40**

Practicals can be done with VS2017, VS2019, Visual Code with ASP.NET Core 3.1.x installed along with Docker and Docker Desktop.

Practical No	Details
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 and Networks.
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.

M. Sc (Information Technology)		Semester – II	
Course Name: Modern Networking		**Course Code: PGIT203**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**4**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**60**
	Theory Internal	**--**	**40**

Objectives

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

Expected Learning Outcomes:

- Demonstrate in-depth knowledge in the area of Computer Networking.
- To demonstrate scholarship of knowledge through performing in a group to identify, formulate and solve a problem related to Computer Networks
- Prepare a technical document for the identified Networking System Conducting experiments to analyze the identified research work in building Computer Networks

Unit	Details	Lectures
I	**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 ApplicationsofWi-Fi,StandardsWi-FiDataRates4G/5GCellularFirst 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 Traffic Characteristics Demand: Big Data, Cloud Computing, and Mobile Traffic Big 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 Modern Networking Elements	**12**
II	**Software-Defined Networks** SDN: Background and Motivation, Evolving Network Requirements Demand Is Increasing, Supply Is Increasing Traffic Patterns Are More Complex Traditional 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 Open Flow SDN Data Plane, Data Plane Functions Data Plane Protocols Open Flow Logical Network Device Flow Table Structure Flow Table Pipeline, The Use of Multiple Tables Group Table Open Flow Protocol, SDN Control Plane SDN Control Plane Architecture Control Plane Functions, Southbound Interface Northbound Interface Routing, ITU-T Model, Open Day light Open Daylight Architecture Open Daylight Helium, 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 Open Daylight 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 Policy Cop Measurement and Monitoring Security Open Daylight DDoS Application Data Center Networking, Big Data over SDN Cloud Networking over	**12**

	SDN Mobility and Wireless Information-Centric Networking CCNx, Use of an Abstraction Layer	
III	Virtualization, Network Functions Virtualization: Concepts and 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, Open Flow VLAN Support, Virtual Private Networks, IP sec VPNs, MPLS VPNs, Network Virtualization, Simplified Example, Network Virtualization Architecture, Benefits of Network Virtualization, Open Daylight's Virtual Tenant Network, Software-Defined Infrastructure, Software- Defined Storage, SDI Architecture	**12**
IV	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, Open Flow 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	**12**

	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	
V	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, 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, DataProtection	**12**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud	William Stallings	Addison-Wesley Professional		October 2015
2.	SDN and NFV Simplified A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization	**Jim Doherty**	Pearson Education, Inc		
3.	Network Functions Virtualization (NFV) with a Touch of SDN	Rajendra Chayapathi Syed Farrukh Hassan	Addison-Wesley		
4.	CCIE and CCDE Evolving Technologies Study Guide	Brad dgeworth, Jason Gooley, Ramiro Garza Rios	Pearson Education, Inc		2019

M. Sc (Information Technology)		Semester – II	
Course Name: Modern Networking Practical		**Course Code: PGIT2P3**	
Periods per week **1 Period is 60 minutes**	**Lectures**	**4**	
	Credits	**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**40**

All practicals are expected to be performed on GNS3/EVE-Ng network Emulator/MININET

Programme Specific Outcome

- Simulating Routing –Switching Techniques

Practical No	Details
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 • Open Daylight SDN Controller with the Mini net Network Emulator • OF Net SDN network emulator
11	Simulating Open Flow Using MININET

M. Sc (Information Technology)		**Semester – II**	
Course Name: Applied Artificial Intelligence		**Course Code: PGIT204**	
Periods per week (1 Period is 60 minutes)		3	
Credits		3	
		Hours	**Marks**
Evaluation System	**Theory Examination**	2½	60
	Internal	--	40

Course Objectives:

- To explore the applied branches of artificial intelligence
- To enable the learner to understand applications of artificial intelligence
- To enable the student to solve the problem aligned with derived branches of artificial intelligence.

Expected Learning Outcomes:

A learner will be able to:

- Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
- Apply basic principles of AI in solutions that require problem solving, inference, perception, Knowledge representation and learning.
- Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications
- Demonstrate profciency in applying scientifc method to models of machine learning

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Unit	Details	Lectures
I	**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**
II	**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**
III	**Machine Learning Paradigms:** Machine Learning systems, supervised and un-supervised learning, inductive learning, deductive learning, clustering, support vector machines, cased based reasoning and learning. **Artificial Neural Networks:** Artificial Neural Networks, Single-Layer feedforward networks, multi-layer feed-forward networks, radial basis function networks, design issues of artificial	**12**

	neural networks and recurrent networks	
IV	**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**
V	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	

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Artificial Intelligence	Saroj Kaushik	Cengage	1st	2019
2.	Artificial Intelligence: A Modern Approach	A. Russel, Peter Norvig		1st	
3.	Artificial Intelligence	Elaine Rich,Kevin Knight,Shivashankar B. Nair	Tata Mc-Grawhill	3rd	

Course Name: Applied Artificial Intelligence Practical		Course Code: PGIT2P4	
Periods per week (1 Period is 60 minutes)		2	
Credits		1	
		Hours	Marks
Evaluation System	Practical Examination	2	50
	Internal	--	--

List of Practical:

10 Practicals covering the entire syllabus must be performed. The detailed list of practical will be circulated later .

M. Sc (Information Technology)		Semester – II	
Course Name: Computer Forensics		**Course Code: PGIT205A**	
Periods per week (1 Period is 60 minutes)		4	
Credits		4	
		Hours	**Marks**
Evaluation System	**Theory Examination**	2½	60
	Internal	--	40

Course Objectives:

- To understand underlying principles and many of the techniques associated with the computer forensic practices and cybercrime.
- To learn the importance of evidence handling and storage for various devices.
- To develop an excellent understanding of current cyber security issues (Computer Security Incident) and analyzed the ways that exploits in securities.
- To investigate attacks, IDS .technical exploits and router attacks and "Trap and Trace" computer networks.
- To apply knowledge to use computer forensic tools and investigation report writing.

Expected Learning Outcomes:

A learner will be able to:

- Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.
- Underline the need of computer forensic.
- Explain the methodology of incident response and various security issues in ICT world, and identify computer forensic tools for data collection .
- Recognize the importance of computer forensic duplication and various tools for analysis to achieve adequate perspectives of computer forensic investigation in various applications.

Unit	Details	Lectures
I	Computer Forensics and Investigation Processes, Understanding Computing Investigations, The Investigator's Office and Laboratory, Data Acquisitions.	**12**
	Processing Crime and Incident Scenes, Working with Windows	**12**

II	and DOS Systems, Current Computer Forensics Tools.	
III	Macintosh and Linux Boot Processes and File Systems, Computer Forensics Analysis, Recovering Graphics Files.	**12**
IV	Virtual Machines, Network Forensics, and Live Acquisitions, E-mail Investigations, Cell Phone and Mobile Device Forensics	**12**
V	Report Writing for High-Tech Investigations, Expert Testimony in High-Tech Investigations, Ethics and High-Tech Investigations.	**12**

Books / References:

Title	Author/s	Edition	Publisher
Guide to Computer Forensics and Investigations	Bell Nelson, Amelia PhilliPG, Christopher Steuart	4th Edition	Cengage Learning
Computer Forensics A Pocket Guide	Nathan Clarke		I.T G.vernance Publishing
Computer Forensics: Computer Crime Scene Investigation	John R. Vacca	2nd Edition	Charles River Media

M. Sc (Information Technology)		Semester – II	
Course Name: Computer Forensics Practical		**Course Code: PGIT2P5A**	
Periods per week (1 Period is 60 minutes)		4	
Credits		2	
		Hours	**Marks**
Evaluation System	**Practical Examination**	2	50
	Internal	--	--

Practical No	Details
1	Using Windows forensics tools
2	Using Data acquisition tools
3	Using file recovery tools
4	Using Forensic Toolkit (FTK)
5	Forensic Investigation using EnCase
6	Using Steganography tools
7	Using Password Cracking tools
8	Using Log Capturing and Analysis tools
9	Using Traffic capturing and Analysis tools
10	Using Wireless forensics tools

M. Sc (Information Technology)		Semester – II	
Course Name: Computer Vision		**Course Code: PGIT205B**	
Periods per week (1 Period is 60 minutes)		4	
Credits		4	
		Hours	**Marks**
Evaluation System	**Theory Examination**	2½	60
	Internal	--	40

Course Objectives:

- To develop the student's understanding of the issues involved in trying to define and simulate perception.
- To familiarize the student with specific, well known computer vision methods, algorithms and results.

- To provide the student additional experience in the analysis and evaluation of complicated systems.
- To provide the student additional software development experience.
- To provide the student with paper and proposal writing experience**.**

Expected Learning Outcomes:

A learner will be able to:

- To implement fundamental image processing techniques required for computer vision
- Understand Image formation process
- To perform shape analysis
- Extract features form Images and do analysis of Images
- Generate 3D model from images
- To develop applications using computer vision techniques
- Understand video processing, motion computation and 3D vision and geometry

Unit	Details	Lectures
I	**Introduction:** What is computer vision?, A brief history, Image formation, Geometric primitives and transformations, Geometric primitives, D transformations, D transformations, D rotations, D to D projections, Lens distortions, Photometric image formation, Lighting, Reflectance and shading, Optics, The digital camera, Sampling and aliasing, Color ,Compression **Feature-based alignment**: D and D feature-based alignment, D alignment using least squares , Application: Panography , Iterative algorithms , Robust least squares and RANSAC , D alignment , Pose estimation , Linear algorithms, Iterative algorithms , Application: Augmented reality , Geometric intrinsic calibration, Calibration patterns, Vanishing points , Application: Single view metrology , Rotational motion ,Radial distortion	**12**
II	**Structure from motion :** Triangulation, Two-frame structure from motion , Projective (uncalibrated) reconstruction, Self-calibration , Application: View morphing , Factorization, Perspective and projective factorization , Application: Sparse D model extraction, Bundle adjustment, Exploiting sparsity , Application: Match move and augmented reality , Uncertainty and ambiguities , Application: Reconstruction from Internet photos , Constrained structure and motion , Line-based techniques , Plane-based techniques **Dense motion estimation :** Translational alignment , Hierarchical motion estimation, Fourier-based alignment ,Incremental refinement , Parametric motion, Application: Video stabilization, Learned motion models , Splinebased motion, Application: Medical image registration, Optical flow, Multi-frame motion estimation ,Application: Video denoising , Application: De-interlacing , Layered motion, Application: Frame interpolation, Transparent layers and reflections	**12**
III	**Image stitching** : Motion models, Planar perspective motion, Application: Whiteboard and document scanning , Rotational panoramas , Gap closing , Application: Video summarization and compression, Cylindrical and	**12**

	spherical coordinates, Global alignment, Bundle adjustment, Parallax removal , Recognizing panoramas, Direct vsfeature-based alignment, Compositing , Choosing a compositing surface, Pixel selection and weighting (de-ghosting) , Application: Photomontage, Blending **Computational photography :** Photometric calibration ,Radiometric response function ,Noise level estimation ,Vignetting ,Optical blur (spatial response) estimation ,High dynamic range imaging ,Tone mapping ,Application: Flash photograpy, Super-resolution and blur removal, Color image demosaicing ,Application: Colorization, Image matting and compositing ,Blue screen matting ,Natural image matting ,Optimization-based matting ,Smoke, shadow, and flash matting ,Video matting ,Texture analysis and synthesis ,Application: Hole filling and in painting ,Application: Non-photorealistic rendering	
IV	**Stereo correspondence** Epipolar geometry , Rectification ,Plane sweep , Sparse correspondence , D curves and profiles , Dense correspondence, Similarity measures , Local methods , Sub-pixel estimation and uncertainty , Application: Stereo-based head tracking , Global optimization , Dynamic programming , Segmentation-based techniques, Application: Z-keying and background replacement, Multi-view stereo, Volumetric and D surface reconstruction, Shape from silhouettes **3D reconstruction :** Shape from X , Shape from shading and photometric stereo, Shape from texture, Shape from focus , Active rangefinding , Range data merging , Application: Digital heritage , Surface representations , Surface interpolation, Surface simplification, Geometry images , Point-based representations, Volumetric representations , Implicit surfaces and level sets , Model based reconstruction, Architecture, Heads and faces , Application: Facial animation , Whole body modeling and tracking ,Recovering texture maps and albedos , Estimating BRDFs ,Application: D photography	**12**
V	**Image-based rendering :** View interpolation, Viewdependent texture maps, Application: Photo Tourism , Layered depth images, Impostors, sprites, and layers, Light fields and Lumigraphs , Unstructured Lumigraph, Surface light fields, Application: Concentric mosaics, Environment mattes, Higher-dimensional light fields , The modeling to rendering continuum, Video-based rendering , Video-based animation, Video textures , Application: Animating pictures, D Video, Application: Video-based walkthroughs **Recognition :** Object detection, Face detection, Pedestrian detection, Face recognition, Eigenfaces, Active appearance and D shape models, Application: Personal photo collections, Instance recognition, Geometric alignment, Large databases, Application: Location recognition, Category recognition, Bag of words, Partbased models, Recognition with segmentation, Application: Intelligent photo editing, Context and scene understanding , Learning and large image collections, Application: Image search, Recognition databases and test sets	**12**

Title	Author/s	Edition	Publisher
Computer Vision: Algorithms and Applications	Richard Szeliski	Springer	1 st Edition

Books and References:

M. Sc (Information Technology)		Semester – II	
Course Name: Computer Vision Practical		**Course Code: PGIT2P5B**	
Periods per week (1 Period is 60 minutes)		4	
Credits		2	
		Hours	**Marks**
Evaluation System	**Practical Examination**	2	50
	Internal	--	--

List of Practical:

10 Practicals covering the entire syllabus must be performed. The detailed list of practical will be circulated later.