M.Sc. COMPUTER SCIENCE

SEMESTER – IV

Paper Code	Paper Title	Credits	No .Of Hrs/Week Therory/practicale	Main Exam Hrs.Thery/Practicale	Marks		Total
					IA	Theory	
HCT4.1	Artificial Intelligence	4	4	3	25	75	100
HCT4.2	Cryptography and Network Security	4	4	3	25	75	100
HCT4.3	Operation Research	4	4	3	25	75	100
HCT4.4	Elective-2	4	4	3	25	75	100
HCP4.1	Artificial Intelligence Lab	4	3	3	25	75	100
SCT4.1	Computer Graphics	4	3	3	25	75	100
SCP4.1	Project	4	3	3	25	75	100

Electives-2

1. Internet of Things
2. Deep learning
3. Cloud Computing
4. Optimization Techniques

SEMESTER-IV

HCT 4.1 Artificial Intelligence

Unit-I

Introduction To Artificial Intelligence, Various Definitions of AI, AI Applications and Techniques, Turing Test and Reasoning - Forward & Backward Chaining.

Unit-II

Intelligent Agents: Introduction To Intelligent Agents, Rational Agent, Their Structure, Reflex, Model- Based, Goal-Based, and Utility-Based Agents, Behavior and Environment In Which A Particular Agent Operates.

Unit-III

Problem Solving and Search Techniques: Problem Characteristics, Production Systems, Control Strategies, Breadth First Search, Depth First Search, Iterative Deepening, Uniform Cost Search, Hill Climbing and Its Variations, Simulated Annealing, Genetic Algorithm Search; Heuristics Search Techniques: Best First Search, A* Algorithm, AO* Algorithm, Minmax& Game Trees, Refining Minmax, Alpha - Beta Pruning, Constraint Satisfaction Problem, Means-End Analysis.

Unit-IV

Knowledge Representation: Introduction To First Order Predicate Calculus, Resolution Principle, Unification, Semantic Nets, Conceptual Dependencies, Semantic Networks, Frames System,Production Rules, Conceptual Graphs, Ontologies. Planning: Basic representation for planning, symbolic-centralized vs. reactive-distributed, partial order planning algorithm. Reasoning with Uncertain Knowledge: Different types of uncertainty - degree of belief and degree of truth, various probability constructs - prior probability, conditional probability, probability axioms, probability distributions, and joint probability distributions, Bayes' rule, other approaches to modellinguncertainty such as Dempster-Shafer theory and fuzzy sets/logic.

Reference Books:

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education, 2015.

2. Elaine Rich and Kelvin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2017.

3. DAN. W.Patterson, Introduction to A.I. and Expert Systems - PHI, 2007.

4. Michael Wooldridge, An Introduction to MultiAgent Systems, 2nd edition, John Wiley & Sons,2009.

5. Fabio Luigi Bellifemine, Giovanni Caire, Dominic Greenwood, Developing Multi-Agent Systems with JADE, Wiley Series in Agent TechnologyJohn Wiley & Sons,2007

6. W.F. Clocksin and C.S. Kaushik, Logic and PrologProlog Programming in PROLOG,5th edtion springer 2003

7. SarojaKaushik logic and prolog programming new age intenatinal publisher 2012.

8.Ivanbartko ,prolog programming for artificial intelligence , Addison –wesleypearson education,4 th edition 2011

HCT 4.2: Cryptography of Nation Security

Unit 1:

Introduction: Security Goals - Attacks - Services and Mechanism
Techniques **Mathematics of Cryptography**: Integer Arithmetic Modular Arithmetic Matrices Linear Congruence Traditional Symmetric Key Ciphers: Instruction-Substitution Ciphers
Transposition Ciphers - Stream and Block Ciphers. Introduction to Modern Symmetric Key Ciphers: Modem Block Ciphers - Modern Stream Ciphers,

Unit 2:

Data Encryption Standard (DES): Introduction - DES Structure - DES Analysis Multiple DES Security of DES. Advanced Encryption Standard (AES): Introduction-Transformations-Key Expansion-Ciphers - Examples- - Analysis of AES.

Unit 3:

Asymmetric Key Cryptography: Introduction - RSA Crypto System. Message Integrity and Message Authentication: Message Integrity - Random Oracle Model Message Authentication.

Unit 4:

Cryptographic Hash Functions: Introduction - SHA-512- WHIRLPOOL. Digital Signature: Comparison - Process Services - Attacks on Digital Signature Digital Signature Schemes.

Unit 5:

Entity Authentication: Introduction - Passwords - Challenge Response - Zero

Knowledge Bio Metrics. Key Management: Symmetric Key Distribution - Kerberos - Symmetric Key Agreement - Public Key Distribution.

Text Book:

Cryptography and Network Security - Behrouz A. Forouzan, TheMcGraw Hill, 2011.

Reference Books:

Unit 1 : Chapters 1,2,3 and 5

Unit 2: Chapters 6 and 7

Unit III Chapters 10 and 11

Unit IV Chapters 12 and 13

Unit V Chapters 14 and 15

REFERENCE:

1. Cryptography and Network Security-William Stallings, PHI, 2008
2. Cryptography and Network Security-AtulKahate, McGraw Hill Education, 2013.
3. Network Security The Complete Reference - Roberta Bragg, Mark
Rhodes Ousley and Strassberg-McGraw Hill Education, 2003.

HCT-4.3: OPERATION RESEARCH**Total Hours: 48**

Unit I 10hrs

Introduction: History. Definitions, Features of Operation Research, Models and modeling OR. Methods for solving OR models, Advantages of OR Sudy. Linear Programming: Structure of Linear programming model, General Mathematical model of LPP. guidelines linear programming models, Examples of LP model formulation.

Unit II 12hrs

Linear programming: Graphical solution Methods of LP problems. Simplex algorithm(Maximization case). Simplex algorithm (Minimization case): two phase and Big-M method. Duality inLinear programming

Unit III 10hrs

Transportation Problem: Mathematical model of transportation problem. The algorithm, NWCM, LCM, VAM, Test for optimality, variations in Transportation problem.

Unit IV 10hrs

Assignment Problem: Mathematical models of Assignment Problem, Hungarian method Assignment problem. Network Models: Scope and definition of Network minimal spanning tree, algorithm, TSP as a network model, project management CPM and PERT

Unit V 6hrs

Decision Theory and Decision Trees: Steps in decision making. Types of Decision making environment Decision making under uncertainty, Decision making under risk, Posterior probabilities and Baysian Analysis, Decision Tree Analysis.

References:

1. Shanna J.K, Operations Research. Theory and Applications, McMillan India Ltd.
2. Hamdy A. Taha. Operations Research, 8/e, Pearson Education.
3. Filet B. E..Introduction to Operation Research: A Computer Oriented Algorithm Approach
4. Gillet B.E, Introduction to Operations Research. TMH.
5. Chandrasekhar Salimath and Bhupenderparashar, Operation Research, University Press 201

SCT-4.1 Computer Graphics

Unit 1
Basic concepts in Computer Graphics - Types of Graphic Devices - Interactive Graphic inputs Raster Scan and Random Scan Displays Line Drawing Algorithm- DDA, Bresenham's algorithm- Circle Generation Algorithms - Mid point circle algorithm, Bresenham's algorithm- Scan Conversion-frame buffers-solid area scan conversion-polygon filling algorithms.

Unit 2
Two dimensional transformations.Homogeneous coordinate systems - matrix formulation and concatenation of transformations. Windowing concepts -Window to Viewport Transformation-Two dimensional clipping-Line clipping - Cohen Sutherland, Polygon clipping-Sutherland Hodgeman algorithm, Three dimensional object representation, Polygon surfaces, Quadric surfaces - Basic 3D transformations .

Unit 3
Three-dimensional viewing: Overview of 3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters, Transformation from world to viewing coordinates, Projection transformations, orthogonal projections (axonometric and isometric, orthogonal projection coordinates, clippingwindow and orthogonal projection view volume, Normalization transformation), Oblique parallel projections (Cavalier and cabinet projections, Clipping window and Oblique parallel-projection view volume, Oblique parallel projection transformation matrix, normalization transformation), Perspective projections (transformation coordinates, perspective- projection equations, vanishing points, view volume, transformation matrix, symmetric and oblique perspective-projection frustum, Normalized perspective-projection transformation coordinates), 3D algorithms (region codes, point and line clipping, polygon clipping)

Unit 4

3D Objectrepresentation: Quadric surfaces, superquadrics, spline representations. detection methods: Classification, Back-face detection, depth-Buffer method, . Wireframe visibility methods.Illumination models and surface rendering methods Visible surface Abuffer method Light sources, Surface lighting effects, Basic illumination models (Ambient light, Diffuse reflection, Specular reflection and the Phong model), polygon rendering methods (constant intensity surface rendering, Gouraud surface rendering, Phong surface rendering), Ray tracing methods - basic Ray-tracing algorithm.

Text Books:
1. Donald Hearn and M. Pauline Baker, Computer Graphics, PHI, 2e, 1996 and Image Analysis, PHI PTR, 1996
2. E. Gose, R. Johnsonbaugh and S. Jost., Pattern Recognition Processing part)
(Module VI – Image

3. William M. Newman and Robert F. Sproull, Principles of Interactive Computer Graphics. McGraw Hill, 2e, 1979
4. Zhigang Xiang and Roy Plastock, Computer Graphics (Schaum's outline Series), McGraw Hill, 1986.

References:

1. David F. Rogers, Procedural Elements for Computer Graphics, Tata McGraw Hill, 2001.

2. M.Sonka, V. Hlavac, and R. Boyle, Image Processing, Analysis, and Machine Vision,
ThomsonIndia Edition, 2007.

4. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. Pearson, 2017.

ELECTIVES
OE 4.1: INTERNET OF THINGS

(5 Hours-4 Credits)

Unit I:

Introduction to Internet of Things: Introduction - Physical Design of loT Logical Design of loT – loT Enabling Technologies – IoT& Deployment Templates. Domain Specific IoT's: Introduction - Home Automation - Cities - Environment - Energy - Retail - Logistics - Agriculture - Industry - Health & Life style.

Unit II:

IoT and M2M : Introduction: M2M - Difference between IoT and M2M- SDN and NFV for IoT.
LoT System Management with NETCONF-YANG: Need for IoT Systems Management Simple Network Management Protocol (SNMP) - Network Operator Requirements - NETCONF-YANG-IoT Systems Management with NETCONF YANG.

Unit III:

IoT Platforms Design Methodology: Introduction – IoT Design Methodology- Case Study on IoT System for Weather Monitoring - Motivation for using Python.
IoT Systems -Logical Design using Python: Introduction - Installing Python - Python Data types & Data Structures - Control Flow - Functions - Modules - Packages - File Handling - Date/Time Operations - Classes - Python packages of Interest for IoT.

Unit IV:

IoT Physical Devices & Endpoints: What is an IoT Device Exemplary Device: Raspberry Pi - About the Board - Linux on Raspberry Pi - Raspberry Pi Interfaces-Programming Raspberry Pi with Python - Other IoTdevices.

IoT Physical Servers & Cloud Offerings: Introduction to Cloud Storage Models & Communication APIs - WAMP - AutoBahn for loT- Xively Cloud for loT-Python Web application Framework-Django - Designing a REST ful
Web API- Amazon Web Services for loT-Skynetlo" messaging platform.

Unit V:

Case Studies Illustrating IoT Design: Introduction - Home Automation Cities-Environment - Agriculture-Productivity applications

Data Analytics for lot': Introduction - Apache Hadoop - Using HadoopMapReduce for Batch Data Analysis - Apache Oozier-Apache Spark-Apache Storm Using Apache Storm for Real-time Data Analysis.

Text Book:

1. Internet of Things, ArshdeepBahga, Vijay Madisetti, Universities Press (INDIA) Private Ltd., 2015.

Unit I :Chapters 1 and2

Unit II :Chapters 3 and 4

Unit III :Chapters 5 and 6

Unit IV :Chapters 7 and 8

Unit V :Chapters 9 and 10

Reference Books:

1. Getting Started with the Internet of Things, CunoPfister, O'Relly, 2011.

2. Designing the Internet of Things, AdrianMcewen, HakinCassimally, Willey, 2015.

3. The Internet of Things in the Cloud: A Middleware Perspective,Honbo Zhou, CRC Press, 2012.

4. Architecting the Internet of Things, Dieter Uckelmann; Mark Harrison; Florian Michahelles, (Eds.) Springer, 2011.

5. The Internet of Things, Key Applications and Protocols, Oliver Hersent, David Boswarthick, Omar Elloumi, Wiley, 2017

OE-4.2 DEEP LEARNING

Credit: 3

Course Learning Outcomes:	**CO1:** Describe The Feed Forward And Deep Networks. **CO2:** Design Single and Multi-Layer Feed-Forward Deep Networks and Tune Various Hyper-Parameters. **CO3:** Analyse Performance of Deep Networks.

Unit-1

Introduction: Historical Context and Motivation For Deep Learning; Basic Supervised Classification Task, Optimizing Logistic Classifier Using Gradient Descent, Stochastic Gradient Descent, Momentum, and Adaptive Sub-Gradient Method.

Neural Networks: Feed-Forward Neural Networks, Deep Networks, Regularizing A Deep Network, Model Exploration, And Hyper-Parameter Tuning.

Unit-2

Convolution Neural Networks: Introduction To Convolution Neural Networks: Stacking, Striding and Pooling, Applications Like Image, and Text Classification.

Unit-3

Sequence Modeling, Recurrent Nets, Unfolding Computational Graphs, Recurrent Neural Networks (Rnns), Bidirectional Rnns, Encoder-Decoder Sequence To Sequence Architectures, Deep Recurrent Networks.
Autoencoders: Undercompleteautoencoders, Regularized Autoencoders, Sparse Autoencoders, Denoisingautoencoders, Representational Power, Layer, Size, and Depth of Autoencoders, Stochastic Encoders and Decoders.

Unit-4

Structuring Machine Learning Projects:Orthogonalization, Evaluation Metrics, Train/Dev/Test Distributions, Size of The Devand Test Sets, Cleaning Up Incorrectly Labeled Data, Bias and Variance
With Mismatched Data Distributions, Transfer Learning, Multi-Task Learning.

Reference Books:

1. LanGoodfellow, Deep Learning, MIT Press, 2016.
2. Jeff Heaton, Deep Learning And Neural Networks, Heaton Research Inc, 2015.
3. Mindy L Hall, Deep Learning, VDM Verlag, 2011
4. Li Deng (Author), Dong Yu, Deep Learning: Methods and Applications (Foundations and Trendin Signal Processing), Now Publishers Inc, 2009.

OE-4.3: CLOUD COMPUTING

(5 Hours-4 Credits)

Unit I:

Cloud Architecture And Model: Technologies For Network-Based System System Models For Distributed and Cloud Computing-NIST Cloud Computing Reference Architecture. Cloud Models:- Characteristics - Cloud Services Cloud Models (Laas, Paas, Saas) - Public Vs Private Cloud -Cloud Solutions. Cloud Ecosystem-Service Management - Computing On Demand.

Unit II:

Virtualization: Basics Of Virtualization - Types Of Virtualization Implementation Levels of Virtualization - Virtualization Structures - Tools And Mechanisms - Virtualization Of CPU, Memory, I/O Devices - Virtual Clusters And Resource Management - Virtualization For Data-Center Automation.

Unit III:

Cloud Infrastructure: Architectural Design of Compute And Storage Clouds - Layered Cloud Architecture Development - Design Challenges Inter Cloud Resource Management - Resource Provisioning And Platform Deployment - Global Exchange of Cloud Resources.

Unit IV:

Programming Model: Parallel and Distributed Programming Paradigms Mapreduce, Twister and Iterative Mapreduce-Hadoop Library From Apache- Mapping Applications - Programming Support Google App Engine, Amazon AWS-Cloud Software Environments -Eucalyptus, Open Nebula, Openstack, Aneka, Cloudsim.

Unit V:

Security In The Cloud: Security Overview - Cloud Security Challenges and Risks Software-As-A-Service Security Security Governance - Risk Management Security Monitoring - Security Architecture Design - Data Security Application Security Virtual Machine Security Identity Management and Access Control-Autonomic Security.

Text Book:

Distributed and Cloud Computing, From Parallel Processing To The Internet of Things Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Morgan Kaufmann Publishers, 2012.

Unit I Chapters 1 And 2

Unit II Chapters 3 And 4

Unit III Chapters 5 And 6

Unit IV Chapters 7 And 8

Unit V Chapters 9

Reference:

1. Cloud Computing: Implementation, Management, and Security, John W.Rittinghouseand James F.Ransome, CRC Press, 2010.

2 .Cloud Computing, A Practical Approach, Toby Velte, Anthony Velte, Robert Elsenpeter, Mcgraw Hill Education, 2009.

3. Cloud Computing - Insights Into New-Era Infrastructure, Kumar Saurabh, Wiley India, 2011.

OE-4.4: Optimization Techniques

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3	1	0	3

Prerequisites:

- Fondamental Knowledge Of Calculus Und Near Programming Problem
- Mathematical Models

Objectives:

- To Introduce The Fundamental Concepts of Optimization Techniques
- To Make The Learners Aware of The Importance Of Optimizacions In Real Scenarios

Outcomes

- Ability To Apply The Concepts of Various Classical and Modern Methods For Constrained and Unconstrained Problems In Both Single and Multivariable Problems

Module-I: Classical Methods & Linear Programming Problems Terminology[9 Hrs)
Introduction To Classical Methods & Linear Programming Problems Terminology, Design Variables-Constraints Objective Function-Problem Formulation, Colculus Method-Kuhn Tucker Conditions-Method of Multipliers. Linear Programming Problem-Simplex Method-Concept of Duality.

Module-Ii: Single Variable Optimization(9 Hrs)
Single Variable Optimization: Problems Optimality Criterion Bracketing Method - Region Elimination Methods Interval Halving Method-Fibonacci Search Method-Golden Section Method, Gradient Based Methods: Newton - Raphson Method-Bisection Method-Secant Method-Application To Root Finding.

Module-Iii: Multivariable Optimization Algorithms (9 Hrs)
Multivariable Optimization Algorithms Optimality: Criteria-Unidirectional Search, Direct Search Methods: Hooke Jeeves Pattern Search Method-Powell's Conjugate Direction Method. Gradient Based Methods: Cauchy's Steepest Descent Method-Newton's Method-Marquardt's Method.

Module-Iv: Advance Optimization Techniques (9 Hrs)
Quadratics Programming-Sequential Quadratic Programming- Integer Programming - Penalty Function Method Branch and Bound Method-Geometric Programming

Module-V: Dynamic Programming
Dynamic Programming: Genetic Algorithm - Problem Formulation and Application In Design Of Continuous Beam and Optimal Geometric Layout Of A Truss-Capacity Expansion and Reservoir Operation,

Text Book(S):

1. S.S. Rao: Engineering Optimization: Theory And Practice, New Age International, Third Edition 2013.
2. EjHaugAndJs. Arora, Applied Optimal Design: Mechanical And Structural Systems, Wiley, 1979
.

Reference Book(S):

1. Kalyanmay Deb, Optimization For Engineering Design: Algorithms and Examples,
Prentice Hall of India, Second Edition, 2012.
2. A. Ravindranand Km. Rogsdell, G.V. Reklaites, Engineering Optimization: Methods and
Applications, Wiley, Second Edition, 2006.