BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA
ROURKELA

Curriculum and Syllabus

M.Sc (Computer Science)
for the Admission Batch 2022-23

3rd Semester

Third Semester					
Theory					
Sl. No.	Category	Course Code	Course Title	L-T-P	Credit
1	PC	MSCS301	Compiler Design	3-0-0	3
2	PC	MSCS302	Artificial Intelligence and Machine Learning	3-0-0	3
3	PC	MSCS303	Cloud Computing	3-0-0	3
4	PC	MSCS304	Information Security	3-0-0	3
5	PE	MSCS305 MSCS306 MSCS307	Big Data Analytics Internet of Things Embedded Systems	3-0-0	3
Total Credit (Theory)					**15**
Practical					
1	PC	MSCS350	Information Security Lab.	0-0-3	2
2	PC	MSCS351	AI & ML Lab.	0-0-3	2
3	PC	MSCS352	Cloud Computing Lab.	0-0-3	2
4		MSCS353	Seminar and Technical Writing	0-0-2	1
Total Credit (Practical)					**7**
Total Semester Credit					**22**

MSCS301 COMPILER DESIGN (3-0-0)

Module I (9Hrs)
Introduction to Automata Theory: Alphabet, Language, DFA, NFA, NFA-Є, Equivalence of DFA and NFA, Minimisation of DFA, Regular Language, Regular Expression, Conversion of Regular Expression to FA.

Module II (9Hrs)
Compiler Structure: Model of compilation, various phases of a compiler. Lexical analysis: Interface with input parser and symbol table, token, lexeme and patterns, difficulties in lexical analysis, input buffering. Specification of tokens.
Syntax Analysis: Grammar, Parsing, ambiguity, top down parsing, recursive descent parsing, transformation on the grammars, predictive parsing LL(1) grammar, Bottom up parsing, operator precedence grammars, LR parsers (SLR, CLR, LALR).

Module III(9Hrs)
Syntax directed definitions: Inherited and synthesized attributes, dependency graph, evaluation order, L- and S-attributed definitions. Type checking: type system, type expressions, structural and name equivalence of types, type conversion.
Run time system: storage organization, activation tree, activation record, parameter passing, symbol table, dynamic storage allocation.
Symbol table management: Data structure for symbol table organization. Error Handling and recovery.

Module IV (9Hrs)
Intermediate code generation: intermediate code representation techniques. Intermediate Code generation for control flow, function call, Boolean expressions and procedure calls.
Code optimization: source of optimizations, optimization of basic blocks, loops, code improving transformations.
Code generation and instruction selection: Issues, basic blocks and flow graphs, register allocation, code generation, DAG representation of programs, peep hole optimization.

Text Books:
1. Alfred V. Aho, Ravi Sethi, and Ullman, "Compilers Priciples, Techniques and Tools",2nd Edition, 2012, Pearson Publication
2. K. C. Louden, "Compiler Construction, Principle and Practice",1st Edition, 1997,Cengage Publication

Reference Books:
1. V.Raghvan, "Principles of Compiler Design",1st Edition, 2017, TMH Publication
2. Levine, Mason and Brown, "Lex& Yacc",2nd Edition, 1992, O' Reilly Publication

MSCS302   ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (3-0-0)

Module I (9 Hrs.)
Introduction to AI, AI Problems and AI techniques, Solving problems by searching, Problem Formulation. Intelligent Agents: Structure of Intelligent agents, Types of Agents, Agent Environments . Uninformed Search Techniques: DFS, BFS, Informed Search Methods: Heuristic functions, Hill Climbing, Best First Search, A*, Adversarial Search: Game Playing, Min-Max Search, Alpha BetaPruning.

Module II (9 Hrs.)
Knowledge and Reasoning: A Knowledge Based Agent, WUMPUS WORLD Environment, Propositional Logic, First Order Predicate Logic, Forward and Backward Chaining.Expert Systems: Introduction, Design of Expert systems.

Module III (9 Hrs.)
Introduction MLP. Type of Human Learning, Type of Machine Learning:Supervised, unsupervised, reinforcement, General Model of Learning Agents

Module IV (9 Hrs.)
Supervised: holdout method, K-fold cross- validation method, boot strapping, simple-regression method, unsupervised: clustering, association, reinforcement learning model.

Text Books:
1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition,2010, Pearson Education.
2. Elaine Rich, Kevin Knight, Shivshankar B Nair, Artificial Intelligence, McGraw Hill, 3rd Edition.
3. Tom Mitchell, Machine Learning, McGraw Hill , 1997, ISBN 0-07-042807-7
4. Richard O. Duda, Peter E. Hart, David G. Stork, Pattern classification, Wiley , (2nd edition). Wiley, New York, 2001

Reference Books
1. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", 1st Edition, 1996, PHI Learning Pvt. Ltd., New Delhi.
2. Nills J. Nilsson, "Artificial Intelligence: A New Synthesis", 2nd Edition, 2000, Elsevier India Publications, New Delhi.
3. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer , 2011 edition
4. Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press , 2016

MSCS303   CLOUD COMPUTING (3-0-0)

Module-I (9 Hrs.)
Basics of Cloud Computing: Introduction, Evolution of Cloud Computing, Cluster Computing, Grid Computing, Mobile Computing, Popular Views, Characteristics of Cloud Computing. Need for Cloud Computing, Types of Cloud Deployment Models, Types of Cloud Service Models, Security Paradigms and Issues of Cloud Computing,

Module-II (9 Hrs.)
Some Popular Cloud Service Providers for PaaS, SaaS, IaaS, NIST Cloud Architecture. Cloud Framework: Introduction, Framework for Cloud Computing Environment, Service Oriented Architecture (SOA), Life Cycle of Services in SOA Integrating SOA and the Cloud, Cloud Framework, Framework Constraints, Workflow and Co-ordination of Multiple Activities, Need of Workflow, Examples of Workflow Tools

Module-III (9Hrs.)
Virtualization: Introduction, Needs of Virtualization in Cloud Computing Environment, Advantages of Virtualization Technique in Cloud Computing Environment, Category of Virtual Machine, Virtualization Model for Cloud Computing, Categorization of Guest OS Virtualization Techniques, Mapping Technique of Virtual Machine to Physical Machine in a
Private Cloud, Draw Backs of Virtualization

Module-V (9Hrs.)
Computing Platforms and Technologies: Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Case Studies: Application Paradigms of Cloud Computing, Security Threats and Protection in Cloud Computing

Text Books:
1. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola,S.ThamaraiSelvi, 1st Edition 2013,TMH.
2. George Reese Cloud Application Architectures, First Edition, 2009, O'Reilly Media.

References Books:
1. Cloud Computing and SOA Convergence in Your Enterprise A Step-by-Step Guide by David S. Linthicum,1st Edition, 2009, Pearson.
2. Cloud Computing, Dr. Kumar Saurabh, 2nd Edition, 2012, Wiley India.

MSCS304   INFORMATION SECURITY (3-0-0)

Module-I (9Hrs)
The Security Problem in Computing:The meaning of computer Security, Computer Criminals, Methods of Defense; Elementary Cryptography: Substitution Ciphers, Transpositions, Making "Good" Encryption Algorithms, Private-Key Cryptosystems, The Data Encryption Standard, The AES Encryption Algorithm, Public-Key Cryptosystems, Public Key Encryptions, Uses of Encryption, Pseudo-randomness, and Hashing.

Module-II (9Hrs)
Program Security :Secure Programs, Non-malicious Program Errors, viruses and other malicious code, Targeted Malicious code, controls Against Program Threats, Protection in General-Purpose operating system protected objects and methods of protection memory and address protection, File protection Mechanisms, User Authentication Designing Trusted O.S : Security polices, models of security, trusted O.S. design, Assurance in trusted OS, Implementation examples. Digital Signatures, Authentication, Secret Sharing, Group oriented cryptography, Identification.

Module-III (9Hrs)
Data base & Network Security: Security requirements, Reliability and integrity, Sensitive data, Inference, multilevel database, proposals for multilevel security; Security in Network; Threats in Network, Network Security Controls, Firewalls, Intrusion Detection Systems, Secure E-mail.

Module-IV (9Hrs)
Administering Security: Security Planning, Risk Analysis, Organizational Security policies Physical Security; The Economics of Cyber security; Privacy in Computing; Legal and Ethical Issues in Computer Security: Protecting Programs and data, Information and the law, Rights of Employees and Employers, Software failures, Computer Crime, Case studies of Ethics.

Textbooks:
1. Charles P. Pfleeger& Shari Lawrence Pfleeger, "Security in Computing", Fourth Edition, 2007, Pearson Education, Inc. New Delhi. Pvt. Ltd., New Delhi.
2. WilliamStallings&Lawrie Brown, "Computer Security: Principles and Practice", First Edition, 2008, Pearson Education, New Delhi.

Reference Books
1. Charlie Kaufman, Radia Perlman& Mike Speciner, "Network Security: Private Communication in a Public World", 2ndEdition, 2003, PHI Learning. New Delhi.
2. ChuckEasttom, "Computer Security Fundamentals", First Edition, 2006, Pearson Education, Inc. New Delhi.

MSCS305 BIG DATA ANALYTICS (3-0-0)

MODULE-I (9Hrs.)
Introduction to Big Data: Analytics, Nuances of big data, Value, Issues, Case for Big data, Big data sources, Acquisition, Nuts and Bolts of Big data. Features of Big Data, Security, Compliance, auditing and protection, Evolution of Big data, Best Practices for Big data Analytics, Big data characteristics, Volume, Veracity, Velocity, Variety, Data Appliance and Integration tools.

Module – II (9Hrs.)
Data Analysis : Evolution of analytic scalability, Convergence, parallel processing systems, Cloud computing, grid computing, map reduce, enterprise analytic sand box, analytic data sets, Analytic methods, analytic tools, Cognos, Microstrategy, Pentaho. Analysis approaches, Statistical significance, business approaches, Analytic innovation, Traditional approaches.

Module – III (8 Hrs.)

Stream Computing : Introduction to Streams Concepts, Stream data model and architecture, Stream Computing, Sampling data in a stream, Filtering streams, Counting distinct elements in a stream, Estimating moments, Counting oneness in a window, Decaying window, Real-time Analytics Platform(RTAP) applications, IBM Infosphere, Big data at rest, Infosphere streams, Data stage, Statistical analysis, Intelligent scheduler, Infosphere Streams

Module – IV (10Hrs)
Predictive Analytics and Visualization : Predictive Analytics, Supervised, Unsupervised learning, Neural networks, Kohonen models, Normal, Deviations from normal patterns, Normal behaviours, Expert options ,Variable entry, Mining Frequent itemsets, Market based model, Apriori Algorithm, Handling large data sets in Main memory, Limited Pass algorithm, Counting frequent itemsets in a stream,
Clustering Techniques, Hierarchical, K- Means, Clustering high dimensional data Visualizations, Visual data analysis techniques, interaction techniques; Systems and applications

Text Books:
1. Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS Business Series
2. Colleen Mccue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis", Elsevier
Reference Books:
1. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press.
2. Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", Second Edition, Elsevier

MSCS306 INTERNET OF THINGS (IoT) (3-0-0)

MODULE I (9 Hrs.)
Introduction to Internet of Things Introduction-Definition & Characteristics of IoT , Physical Design of IoT- Things in IoT , IoT Protocols, Logical Design of IoT- IoT Functional Blocks, IoT Communication Models, IoT Communication APIs , IoT Enabling Technologies- Wireless Sensor Networks , Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, IoT Levels & Deployment Templates.

MODULE II (9 Hrs.)
Domain Specific IoTs Home Automation, Intrusion Detection,Smoke/Gas Detectors, Application of IoT for Smart Cities, Application to Environment , Energy Applications, Retail Applications, Logistics Applications, Agriculture-,Industry Applications of IoT,Health & Lifestyle Applications and M2M Introduction M2M-Difference between IoT and M2M,SDN and NFV for IoT-Software Defined Networking , Network Function Virtualization

MODULE III (9.Hrs)
IoT Platforms Design Methodology-IoT Level Specification, Functional View Specification ,Operational View Specification,Device & Component Integration, Application Development, Motivation for Using Python IoTPhysical Devices &Endpoints,Exemplary Device: Raspberry Pi, Raspberry Pi Interfaces – Serial, SPI , I2C , Programming Raspberry Pi with Python-Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with Raspberry Pi , Other IoT Devices- pc Duino, Beagle Bone Black , Cubieboard

MODULE IV (9 Hrs.)
IoT& Beyond: Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Overview of RFID,Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and dataintensiveIoT for continuous recognition applications. Overview of Android / IOS App Development tools & Internet of Everything

Text Books :
1. Rajkamal,"Internet of Things", 2nd Edition, 2022, Tata McGraw Hill publication.
2. Vijay Madisetti and ArshdeepBahga, "Internet of things(A-Hand-on-Approach)" 1st Edition, 2015, Universal Press.

Reference Books :
1. Charless Bell "MySQL for the Internet of things". 1st Edition, 2016, Apress publications.
1. 2. Francis dacosta "Rethinking the Internet of things:A scalable Approach to connecting everything", 1st edition, 2014, Apress publications.

MSCS307 EMBEDED SYSTEMS (3-0-0)

MODULE-I: (9Hrs.)
Introduction to Embedded Systems : Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

MODULE-II: (9Hrs.)
Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

MODULE-III: (9 Hrs)
Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

MODULE-IV: (9 Hrs)
RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.
Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Text Books:
1. Shibu K.V, "Introduction to Embedded Systems", McGraw Hill Publishing

Reference Books:
1. Raj Kamal, "Embedded Systems", TMH Publishing
2. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley Publishing

MSCS350 INFORMATION SECURITY LAB (0-0-3)

1. Implement Caeser cipher substitution operation.
2. Implement monoalphabetic and polyalphabetic cipher substitution operation.
3. Implement Vigenere Cipher
4. Implement Playfair cipher substitution operation.
5. Implement Hill cipher substitution operation.
6. Implement Rail fence cipher transposition operation.
7. Implement row transposition cipher transposition operation.
8. Implement product cipher transposition operation.
9. Illustrate the Ciphertext only and Known plaintext attacks.
10. Implement a stream cipher technique

MSCS351 AI & ML LAB (0-0-3)

1. Write a Program to Implement Breadth First Search using Python.
2. Write a Program to Implement Depth First Search using Python.
3. Write a Program to Implement Tic-Tac-Toe game using Python.
4. Write a Program to Implement 8-Puzzle problem using Python
5. Write a Program to Implement Water-Jug problem using Python
6. Write a python program to import and export data using Pandas library functions
7. Demonstrate various data pre-processing techniques for a given dataset
8. Implement Simple Linear Regression Models
9. Develop Decision Tree Classification model for a given dataset and use it to classify a new sample.
10. Build KNN Classification model for a given dataset.

MSCS352 CLOUD COMPUTING LAB. (0-0-3)

List of Experiments
1. Install Virtual box/VMware Workstation with different flavours of linux or windows OS on top of windows 10 or 11.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.
3. Introduction to linux operating system and commands.
4. Control systems command to clone, commit, push, fetch, pull, checkout, reset, and delete.
5. Install Google App Engine. Create hello world app and other simple web applications using python/java.
6. Use GAE launcher to launch the web applications.
7. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
8. Find a procedure to transfer the files from one virtual machine to another virtual machine.
9. Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version).
10. Install Hadoop single node cluster and run simple applications like word count.

MSCS353 SEMINAR AND TECHNICAL WRITING (0-0-2)

There shall be a seminar in M. Sc (Computer Science) course. For seminar the student shall collect the information on a specialized topic and prepare a technical report, showing his/her understanding on the topic, and submit it to the Department. Further, student has to give a presentation on the seminar report before departmental committee. After successful presentation of seminar each student have to submit a technical report in the department.

The marks for seminar are awarded as follows:
1) Day to day work -   20 Marks
2) Report preparation -   20 Marks
3) Seminar Presentation -   40 Marks
4) Viva-Voce on the Seminar topic -   20 Marks
Total -   100 Marks

4th Semester

Fourth Semester					
Theory					
Sl. No.	Category	Course Code	Course Title	L-T-P	Credit
1	PC	MSCS450	Dissertation Evaluation and Open Defence		12
2	PC	MSCS451	Comprehensive Viva – Voce		4
3			MOOCS -1 (08 – 12 Weeks)*		3
4			MOOCS -2 (08 – 12 Weeks)*		3
Total Credit (Theory)					16+6*

* The MOOCs courses can be taken by the student in any semester from second semester onwards. However, these two courses must be completed before the final declaration of result.

MSCS450   DISSERTATION EVALUATION AND OPEN DEFENCE

There shall be an M. Sc. dissertation in the 4th semester. The student shall investigate or work on a topic in any subject related to the course. During the dissertation work student shall do experimental or review work or any other type of project approved by the Departmental committee consisting of senior faculty members of different specialization and HOD. The committee should adopt a rational approach in assigning project supervisor to a student in 4th semester with respect to the research interest of the students in different specializations. When a student chooses to do project work in an industries/reputed institutions/universities then the internal faculty member should be the one of the supervisor for completion of the dissertation. Attendance of such students doing project shall be furnished by the internal supervisor based on his interaction with the student. At the end of the 4th Semester the student shall submit a project report and give a power point presentation before the Departmental committee with external Examiner(s) outside the University in the relevant fields.

The award of Marks for the dissertation
1) Day to day work (awarded by the Supervisor) -   100 Marks
2) Dissertation (Awarded by the Committee) -   200 Marks
3) Presentation of dissertation Seminar (Awarded by the Committee) - 100 Marks
4) Viva Voce (Awarded by the Committee) -   100 Marks
Total: 500 Marks

MSCS451   COMPREHENSIVE VIVA – VOCE

There shall be a Comprehensive Viva-Voce at the end of 4th semester. The Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and Senior Faculty members of the Department covering different specializations and External Examiners from academic institutes. The Comprehensive Viva-Voce is intended to assess the student's understanding of the subjects he/she studied during the M.Sc. course of study. The Comprehensive Viva-Voce is evaluated for 100 marks by the Committee. There are no internal marks for the Comprehensive Viva-Voice.