# ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.
**Syllabus (Effective from 2023-24)**

**School/ Department: School of Computer Sciences
Course: M. Tech. (SSP), Programme: Computer Science and Engineering (CSE),
Duration: 2 years (Four Semesters)**

**2nd Semester**

| Sl. No. | Subject Type | Subject Code | Subject Name | Teaching Hours | | | Credit | Maximum Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | IA | EA | PA | Total |
| 1 | PC 3 | CS6102 | High Performance Computing | 3 | 0 | 0 | 3 | 40 | 60 | - | 100 |
| 2 | PC 4 | CS6104 | Object Oriented Analysis and Design | 3 | 0 | 0 | 3 | 40 | 60 | - | 100 |
| 3 | PE 2 (Any One) | CS6202 | Machine Learning Applications | 3 | 0 | 0 | 3 | 40 | 60 | - | 100 |
| | | CS6204 | Computer Graphics | | | | | | | | |
| | | CS6206 | Mobile Computing | | | | | | | | |
| 4 | PE 3 (Any One) | CS6208 | Computer Vision | 3 | 0 | 0 | 3 | 40 | 60 | - | 100 |
| | | CS6210 | Cloud Computing | | | | | | | | |
| | | CS6212 | Digital Forensics | | | | | | | | |
| 5 | OE 1 | | Any One from the List of OE 1 (Appendix-I) | 3 | 0 | 0 | 3 | 40 | 60 | - | 100 |
| 6 | PR 1 | CS6602 | Project (Specialization Related) | 0 | 0 | 4 | 2 | - | - | 100 | 100 |
| 7 | LC 3 | CS6502 | Computing Lab - II | 0 | 0 | 4 | 2 | - | - | 100 | 100 |
| 8 | AC 2 | | Any One from the List of AC 2 (Appendix-I) | 2 | 0 | 0 | 0 | 40 | 60 | - | 100 |
| | | | **Total** | **17** | **0** | **8** | **19** | **240** | **360** | **200** | **800** |

**3rd Semester**

| Sl. No. | Subject Type | Subject Code | Subject Name | Teaching Hours | | | Credit | Maximum Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | IA | EA | PA | Total |
| 1 | PE 4* (Any One) | CS7201 | Software Testing | 3 | 0 | 0 | 3 | 40 | 60 | - | 100 |
| | | CS7203 | Human Computer Interaction | | | | | | | | |
| | | CS7205 | Real Time Systems | | | | | | | | |
| 2 | PR 2 | CS7601 | Dissertation (Phase-I) | 0 | 0 | 24 | 12 | - | - | 100 | 100 |
| | | | **Total** | **3** | **0** | **24** | **15** | **40** | **60** | **100** | **200** |

* Virtual/Online Course either offered by OUTR or available in MOOCs platform (No physical class)

**4th Semester**

| Sl. No. | Subject Type | Subject Code | Subject Name | Teaching Hours | | | Credit | Maximum Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | IA | EA | PA | Total |
| 1 | PR 3 | CS7602 | Dissertation (Phase-II) | 0 | 0 | 32 | 16 | - | - | 100 | 100 |
| | | | **Total** | **0** | **0** | **32** | **16** | **-** | **-** | **100** | **100** |

**Credits and Maximum Marks**

| Sl. No. | Semester | Credits | Maximum Marks |
|---|---|---|---|
| 1 | 1st | 18 | 800 |
| 2 | 2nd | 19 | 800 |
| 3 | 3rd | 15 | 200 |
| 4 | 4th | 16 | 100 |
| | Total | 68 | 1900 |

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### 2nd Semester

| PC 3 | CS6102 | High Performance Computing | 3 | 0 | 0 | 3 |
|------|--------|----------------------------|---|---|---|---|

**Course Outcomes:**
On successful completion of the course, the student will be having the basic knowledge of computing technology.
1. Student will be able to understand pipelining and hazards.
2. Student will be able to know array processors.
3. Know about instruction level parallelism.
4. Student will be able to know multiprocessor architecture. Students will know different parallel memory organizations and their issues.

**Module-I:**
Introduction: review of basic computer architecture, quantitative techniques in computer design,measuring and reporting performance. CISC and RISC processors. Pipelining: Basic concepts,instruction and arithmetic pipeline, data hazards, control hazards, and structural hazards, techniques for handling hazards.

**Module-II:**
Array processors: SIMD array processor, SIMD computer organization, SIMD Interconnection network. Vector processor, characteristics.
Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super-pipelined and VLIW processor architectures.

**Module-III:**
Multiprocessor architecture: functional structures: UMA, NUMA, Distributed Memory architectures, Loosely Coupled & Tightly Coupled Multiprocessor, Processor characteristics of multiprocessor, Interconnection networks. Parallel memory organizations: Interleaved memory, L-M organization, cache coherence.

**Reference Books:**
1. Computer Architecture & Parallel Processing. Kai Hwang & Briggs, McGraw-Hill.
2. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach,
Morgan Kaufmann.
3. John Paul Shen and Mikko H. Lipasti, Modern Processor Design: Fundamentals of Superscalar Processors, Tata McGraw-Hill.
4. M. J. Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House.

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| PC 4 | CS6104 | Object Oriented Analysis and Design | 3 | 0 | 0 | 3 |
|------|--------|-------------------------------------|---|---|---|---|

**Course Outcomes:**
1. Understand the basics object model for System development and object-Oriented Methodologies
2. Demonstrate software design with UML diagrams
3. Understand the concept of Relationships
4. Design software applications using OO concepts.
5. Analyze various testing methodologies for OO software and compare and contrast various testing techniques

**Module-I:**
**Introduction:** Overview Of OOL; Object Oriented Concepts, Object Oriented System Development Lifecycle, Object Oriented Methodologies; The Unified Approach
**Unified Modeling Language:**Overview of Unified Modeling Language (UML), Static and Dynamic Models, UML Diagrams, UML Class Diagrams, Use-Case Diagrams, UML Dynamic Modeling, Implementation diagrams, Model Management: Package and Model Organization, UML Extensibility, UML Meta-Model.

**Module-II:**
**Object Oriented Analysis – Identifying Use-Cases:** Complexity in Object Oriented Analysis, Business Process Modeling and Business Object Analysis, Use-Case Driven Object Oriented Analysis, Use-Case Model, Developing Efficient Documentation.
**Object Analysis: Classification:** Object Analysis, Classification Theory, Approaches for Identifying Classes, Class Responsibility Collaboration.
**Object Oriented Analysis – Identifying Relationships, Attributes, and Methods:** Introduction, Associations, Inheritance Relationships, A Part of Relationship-Aggregation, Class Responsibility: Identifying Attributes and Methods, Class Responsibility: Defining Attributes, Object Responsibility: Methods and Messages.
**Object Oriented Design Process and Design Axioms:** Design Process, Design Axioms, Corollaries, Design Patterns.
**Designing Classes:** The Object Oriented Design Principles, UML Object Constraint Language (OCL), Strategies for Designing Classes, Class Visibility: Designing Public Private and Protected Protocols, Designing Classes: Refining Attributes, Designing Methods and Protocols, Packages and Managing Classes.

**Module-III:**
**Access Layer:** Object Store and Persistence, Database Management Systems, Logical and Physical Database Organization and Access Control, Object Oriented Database Management Systems (OODBMS), Object Relational Systems, Designing Access Layer Classes.
**View Layer:** User Interface Design as a Creative Process, Designing View Layer Classes, Purpose of a View Layer Interface, Prototyping the User Interface.
**Software Quality Assurance:** Quality Assurance Tests, Software Testing Techniques, Testing Strategies, Impact of Object Orientation on Testing, Test Cases, Test Plan, Myer's Debugging Principles.
**System Usability and Measuring User Satisfaction:** Usability Testing, User Satisfaction Test, Analyzing User Satisfaction by Satisfaction Test Template, Developing Usability Test Plans and Test Cases.

**Text/References:**

1. Ali Bahrami, "Object Oriented System Development", McGraw Hill, 1999.
2. Grady Booch, J. Rambaugh and Ivar Jacobson, "The UML Users guide", Addison-Wesely, 2/e, 2005.
3. J. Rambaugh and M. R. Blaha, "Object Oriented Modeling and Design", Prentice Hall, 2/e, 2004.
4. Andrew Haigh, "Object Oriented Analysis and Design", Tata McGrawHill, 2001.
5. Stephen R. Schach, "Object Oriented and Classical Software Engineering", 8/e, 2010.

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| PE 2 | CS6202 | Machine Learning Applications | 3 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|

**Course Outcomes:**
1. Learn the basics of learning problems with hypothesis and version spaces
2. Understand the features of machine learning to apply on real world problems
3. Analyze the concept of neural networks for learning linear and non-linear activation functions
4. Learn the concepts in Bayesian analysis from probability models and methods
5. Understand the fundamental concepts of NLP, Data mining, HCI with application

**Module-I:**
Introduction to Machine learning system: Types of learning, Algorithmic models of learning, Classification, Regression, hypothesis space and inductive bias, Evaluation.
Basic Mathematical and Statistical concepts: Metric, Matrices, Eigen values and Eigen vectors, mean, median, mode, variance, co-variance, correlation, Binomial distribution and normal distribution, Basic concepts in probabilistic models such as Bayes theorem, Bayesian, maximum a posteriori and minimum description length frameworks.

**Module-II:**
Algorithm models of learning, Learning classifiers, Linear, Nonlinear, Multiple and logistic Regression, Linear Discriminant Analysis (LDA), Decision trees, K-mean and Hierarchical clustering, Support Vector Machine (SVM), Bayesian networks, Markov and Hidden Markov models, k-nearest neighbor classifiers,

**Module-III:**
Neural networks: Perceptron, Multilayer Artificial Neural Network, Back Propagation Learning Algorithm, Radial Basis Network, Applications on ANN.
Computational learning theory, mistake bound analysis, Occam learning, accuracy and confidence boosting. Dimensionality reduction, Principal Component Analysis (PCA), feature selection and visualization.
Reinforcement learning, learning from heterogeneous, distributed data and knowledge. Selected applications in data mining, automated knowledge acquisition, pattern recognition, text and language processing, human-computer interaction.

**Text Book:**
1. Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag
2. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
3. EthemAlpaydin, Introduction to Machine Learning, MIT Press (MA), 2004.

**Reference Books:**
1. Baldi, P. and Brunak, S. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press.
2. Baldi, P., Frasconi, P., Smyth, P. (2003). Modeling the Internet and the Web - Probabilistic Methods and Algorithms. New York: Wiley.
3. Bishop, C. M. Neural Networks for Pattern Recognition. New York: OxfordUniversity Press (1995).
4. Chakrabarti, S. (2003). Mining the Web, Morgan Kaufmann.
5. Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press.
6. Cowell, R.G., Dawid, A.P., Lauritzen, S.L., and Spiegel halter, D.J. (1999). Graphical Models and Expert Systems.Berlin: Springer.
7. Cristianini, N. and Shawe-Taylor, J. (2000). An Introduction to Support Vector Machines. London: Cambridge University Press.Duda, R., Hart, P., and Stork, D. (2001). Pattern Classification. New York: Wiley.

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| PE 3 | CS6210 | Cloud Computing | 3 | 0 | 0 | 3 |
|------|--------|-----------------|---|---|---|---|

**Course Outcomes:**
**At the end of this course student will:**
6. Understand the concept of virtualization and how this has enabled the development of Cloud Computing
7. Know the fundamentals of cloud, cloud Architectures and types of services in cloud
8. Understand scaling, cloud security and disaster management
5. Design different Applications in cloud
**6.** Explore some important cloud computing driven commercial systems

**Module-I:**
**Introduction:** Cloud-definition, benefits, usage scenarios, History of Cloud Computing – Cloud Architecture – Types of Clouds – Business models around Clouds – Major Players in Cloud Computing – issues in Clouds – Eucalyptus – Nimbus – Open Nebula, CloudSim, Risks Involved in Cloud Computing. **Cloud Services:** Types of Cloud services: Software as a service – Platform as a Service – Infrastructure as a Service – database as a Service – Monitoring as a Service – Communication as services, Service providers – Google, Amazon, Microsoft Azure, IBM, Salesforce.

**Module-II:**
**Collaborating Using Cloud Services:** Email Communication over the Cloud – CRM Management – Project Management – Event Management – Task Management – Calendar – Schedules – Word Processing – Presentation – Spreadsheet – Databases – Desktop – Social Networks and Groupware, Work Loan Management in Cloud. **Virtualization For Cloud:** Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization – System Vm, Process VM, Virtual Machine monitor – Virtual machine properties – Interpretation and binary translation, HLL VM – Hypervisors – Xen, KVM, VMWare, Virtual Box, Hyper-V.

**Module-III:**
**Data & Cloud Storage:** Enterprise Data Storage (SAN, NAS), Cloud File System, Cloud Data stores & Data management for cloud storage.
**Other Ways to Collaborate Online:** Collaborating via Web – Based Communication Tools – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis.
**Security, Standards and Applications:** Security in Cloud: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed Management Task Force – Standards for application Developer – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud.

**Text/ References:**
1. John Rittinghouse and James Ransome, "Cloud Computing, Implementation, Management andStrategy", CRC Press, 2009.
2. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate", Que Publishing, August 2008.
3. James E Smith and Ravi Nair, "Virtual Machines", Morgan Kaufmann, 2006.
4. David E. Y. Sarna, "Implementing and Developing Cloud Application", CRC press 2011.
5. Lee Badger, Tim Grance, Robert Patt-Corner and Jeff Voas, NIST Draft cloud computing synopsis and recommendation, 2011.
6. Anthony T Velte, Toby J Velte and Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw-Hill, 2009.

| AC 2 | IP6002 | Disaster Management | 2 | 0 | 0 | 0 |
|------|--------|---------------------|---|---|---|---|

**Course Objectives:**
1. To make the students understand the concepts of disasters and its classification.
2. To make the students understand the impact of disaster.
3. To understand emerging approaches in Disaster Management.
4. To make the students apply the knowledge of disaster management.

**Module–I**

Introduction: Concepts and definitions: Disaster, hazard, vulnerability, resilience, risks, frequency and details, capacity, impact, prevention, mitigation.

Disasters: Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); man-made disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility. Disaster Impacts: Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability, etc. Dos and Don'ts during various types of Disasters.

**Module–II**

Disaster Risk Reduction (DRR): Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment. Emerging approaches in Disaster Management - Three stages: Pre-disaster stage (preparedness), Emergency stage and Post Disaster stage – Rehabilitation. Roles and responsibilities of government, community local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programs in India and the activities of National Disaster Management Authority.

**Module–III**

Disasters, Environment and Development: Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods. Disaster management: Applications and case studies - Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**Text/Reference Books:**
1. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.
2. Pradeep Sahni, "Disaster Mitigation: Experiences and Reflections", Prentice Hall, 2004.
3. Singhal J.P. "Disaster Management", Laxmi Publications, 2010.
4. Donald Hyndman &amp; David Hyndman, "Natural Hazards &amp; Disasters", Cengage Learning, 2010.
5. Singh B.K., Handbook of Disaster Management: Techniques &amp; Guidelines, Rajat Publication, 2008.
6. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.

**Course Outcomes:**
**CO1:** Understand the Concepts of Disaster and its impact.
**CO2:** Apply the Dos and Don'ts during various types of Disasters.
**CO3:** Analyze the Disaster Risk Reduction: structural and non-structural measures
**CO4:** Understand the Rehabilitation, roles and responsibilities of government for Disaster Management
**CO5:** Design a sustainable and environment friendly recovery
**CO6:** Adapt various Case Studies and Inputs for Disaster Mitigation

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | L | M | M | M | M | H | H | H | H | H | L | L | L | H | M |
| CO2 | L | M | M | M | M | H | H | H | H | H | L | L | L | H | M |
| CO3 | L | M | M | M | M | H | H | H | H | H | L | L | L | H | M |
| CO4 | L | M | M | M | M | H | H | H | H | H | L | L | L | H | M |
| CO5 | L | M | M | M | M | H | H | H | H | H | L | L | L | H | M |
| CO6 | L | M | M | M | M | H | H | H | H | H | L | L | L | H | M |

| OE 1 | EI6304 | IoT and its Applications | 3 | 0 | 0 | 3 |
|------|--------|--------------------------|---|---|---|---|

**Prerequisites:**
 Basic Knowledge in Computer Networks, OSI Model, Programming Skills

**Course Outcomes:**
At the end of this course, students will be able to
1. Interpret and apply the concept of IOT and M2M
2. Apply IoT architecture and applications in various fields
3. Apply the security and privacy issues in IOT.
4. Implement IoT Applications

**MODULE I**
**Introduction to Internet of Things:** Application areas of IoT, Characteristics of IoT, Things in IoT, IoT stack, Enabling technologies, IoT challenges, IoT levels, IoT and cyber-physical system, IoT and WSN.
**Sensors, Microcontrollers, and Their Interfacing:** Sensor interfacing, Types of sensors, Controlling sensors, Microcontrollers, ARM.

**MODULE II**
**Protocols for IoT :** Messaging protocols, Transport protocols, IPv4, IPv6, URI
**Cloud for IoT:** IoT and cloud, Fog computing, Security in cloud
**Application Building with IoT:** Various applications of IoT : Food, Healthcare, Lavatory maintenance, Water quality, Warehouse, Retail, Driver Assistance, Collision impact

**MODULE III**
**Arduino and Raspberry Pi:** Arduino : Architecture, Programming and Application
**Raspberry Pi :** Architecture, Programming and Application
**IoT Security:** Various security issues and need, architecture, requirement, challenges and algorithms

**Text Books:**
1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Internet of Things, Vasudevan, Nagrajan and Sundaram, Wiley India

**Reference Book:**
1. IoT Fundamentals, David Hence at el, Cisco Press
2. Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, A press Publications, 2013.
3. Cuno Pfister, "Getting Started with the Internet of Things", O. Reilly Media, 2011.

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| LC 3 | CS6502 | Computing Lab - II | 0 | 0 | 4 | 2 |
|---|---|---|---|---|---|---|

**List of Experiments**

1. Write a Python program to print your name and registration number.
2. Devise a Python program to implement arithmetic operations.
3. Write a Python program to demonstrate use of conditional statements.
4. Devise a Python program to illustrate loop statements.
5. Write a Python program to exhibit function components.
6. Write a Python program to demonstrate use of string manipulations.
7. Display recursion of a function using a Python program.
8. Create a list using a Python program for a given problem.
9. Construct a dictionary using a Python program for a given problem.
10. Demonstrate use of file operations using a Python program.