Grid and Cloud Computing
Credit: 3 + 3 Hr. /Week Lab

1. **Basics of Web Services:**
   Extensible Mark-up Language XML Introduction, some key aspects of XML, Document-centric XML Data-centric XML, XML-based Web Services, Simple Object Access Protocol (SOAP), Web Service Definition Language (WSDL), UDDI (Universal Description Discovery and Integration) discovery that form a basis for Web Services, exploring JAXR, jUDDI, UDDI4J etc. Technologies include HTML, HTTP, XML, SOAP, and WSDL, Development of Java Web Services.

2. **Introduction to Grid Computing**
   Introduction to Grid Computing, Overview of Grid Middleware Distributed Object Technology for Grid Computing (OGSA, WSRF) Grid Middleware, GSI. Developing Grid Services, Grid Computing Security, Resource Management (GRAM), Data Management, Information Services.

3. **Introduction to Cloud Computing**
   Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS Cloud computing platforms: Infrastructure as service: Amazon EC2,Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing

4. **Virtualization and Resource Provisioning in Clouds**
   Introduction to Cloud Technologies, Study of Hypervisors Virtualization Technology: Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization Multitenant software: Multi-entity support, Multi-schema approach, Multi-tenancy using cloud data stores, Data access control for enterprise applications,

5. **Data Management in Clouds**
   Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Map-Reduce and extensions: Parallel computing, Introduction to cloud development, Example/Application of MapReduce, Features and comparisons among GFS,HDFS etc, Map-Reduce model

6. **Security in Clouds**
   Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud computing security architecture: Architectural Considerations - General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control-Identity management, Access control, Autonomic Security Cloud computing security challenges: Virtualization security management- virtual threats, VM Security Recommendations, VM-Specific Security techniques,
   Secure Execution Environments and Communications in cloud.

7. **Programming Enterprise Clouds using Aneka**
   Introduction, Aneka Architecture, Aneka Deployment, Parallel Programming Models, Thread Programming using Aneka, Task Programming using Aneka, and MapReduce Programming using Aneka, Parallel Algorithms, Parallel Data mining, Parallel Mandelbrot, and Image Processing.

8. **Advanced Topics and Cloud Applications**
   Cloud computing platforms, Installing cloud platforms and performance evaluation Features and functions of cloud platforms: Xen Cloud Platform, Eucalyptus, OpenNebula, Nimbus, Apache Virtual Computing Lab (VCL).

Book (Grid and Web Services)
1. Foster, et. al. "Anatomy of the Grid" (globus.org)
2. Foster et. al. "Physiology of the Grid" (globus.org)
3. Anirban Chakrabarti, Grid Computing Security
4. The Globus Toolkit 4 Programmer's Tutorial Borja Sotomayor
5. Beginning Java web services, Henry Bequet et. al., a! press
6. Programming web services with SOAP, James Snell et. al., O' Reilly publisher

Books (Cloud)
1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Mastering Cloud Computing, Tata McGraw Hill, New Delhi, India, 2013.
2. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things
   Kai Hwang , Jack Dongarra , Geoffrey C. Fox.