Course Code	UDS21302J	Course Name	*ADVANCED COMPUTING WITH PYTHON AND GCP*	Course Category	C	Professional Core Course	L	T	P	C
							4	0	2	5

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Applications		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to	Learning	Program Learning Outcomes (PLO)

		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	Understand the role of advanced computing in building artificial intelligent applications.																		
CLR-2 :	Teach the students the role cloud computing, cluster computing and grid computing plays in building Artificial Intelligent solutions.																		
CLR-3 :	To make the students aware of the high performance computing concepts, their building blocks, business benefits, challenges etc.																		
CLR-4 :	Introduce the students to dynamic load balancing that allows each parallel job to do its application level load balancing																		
CLR-5 :	To explore and deploy Cloud networking technologies, including Virtual Private Cloud (VPC) networks, subnets, and firewalls; interconnection among networks; load balancing; Cloud DNS; Cloud CDN; and Cloud NAT services and Cloud-based storage services for business																		
CLR-6 :	To learn about Google Cloud's computing and storage services available, including Compute Engine, Google Kubernetes Engine, App Engine, Cloud Storage, Cloud SQL, and BigQuery.																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Have a strong control over the fundamental concepts of Cloud computing including the ability to clearly define the working definitions of the cloud computing methodologies	2	85	80	H	H	H	H	H	H	M	H	H	H	M	H	L	H	H
CLO-2 :	Have a Strong understanding knowledge and ability of designing enterprise-grade cloud solutions on the various cloud computing services.	3	85	80	H	H	H	H	H	H	M	H	H	H	M	H	L	H	H

CLO-3 :	Have a strong control over the fundamental concepts of high performance computing	3	85	80	H	H	H	H	H	H	M	H	H	H	M	H	L	H	H
CLO-4 :	Able to Utilize the right tool and techniques for processing data in-memory and in real-time.	3	85	80	H	H	H	H	H	H	M	H	H	H	M	H	L	H	H
CLO-5 :	Gain excellent hands-on skill and understanding of creating VM instances on cloud and be able to create Virtual Private Cloud (VPC) networks, subnets	3	85	80	H	H	H	H	H	H	M	H	H	H	M	H	L	H	H
CLO-6 :	Gain Hands-on Knowledge and skills to use Google cloud notebook and vertex AI services and be able to demonstrate the capabilities of deploying them on app engine and cloud run services.	3	85	80	H	H	H	H	H	H	M	H	H	H	M	H	L	H	H

Note: All our curriculum, study materials, assignments, quizzes, lab works, and learning resources are personalized and dynamically generated using machine learning models based on the learner's learning ability. Users can review our learning curriculum only through our intelligent learning management platform (iLMSP), and our learning resources and lab infrastructures are available only in the digital form on our cloud infrastructures.

Duration (hour)		**18**	**18**	**18**	**18**	**18**
S-1	SLO-1	**Unit 1: Working and Architecture of Cluster Computing Grid Computing and Cloud Computing**	**Unit 3: Cloud Computing Building Blocks**	Examples of In-memory Computing	Working of Dynamic Load Balancing	Projects, networks, and subnetworks
	SLO-2	Cluster computing overview	Software Building Blocks ✓ Application Workloads ✓ Virtual Workloads ✓ PaaS ✓ Identity Management ✓ Virtualization	Real Time Computing Overview	Applications of Dynamic Load Balancing	Routes and firewall rules
S-2	SLO-1	Cluster Load Balancing, High Availability Clusters, High Performance Clusters	Hardware Building Blocks ✓ Compute Servers ✓ Storage Servers ✓ Hyper Converged Servers ✓ Physical networks	Business Benefits Real Time Computing Overview	**Unit 10: Parallel Meshing and Remeshing**	VPC Networking
	SLO-2	Working and Architecture of Cluster computing	**Unit 4: High Performance Computing**	Business Challenges Real Time Computing Overview	Meshing Overview, Mesh Topology and Parallel Meshing Overview	Common network designs, Virtual Machines
S-3	SLO-1	Grid computing overview	High Performance Computers	Working of Real Time Computing	Business Benefits, Challenges & Applications of Parallel Meshing	**Unit 14: Google Cloud Platform Compute, Kubernetes, App Engine**

	SLO-2	Computational Grid Computing, Data Grid Computing, Collaborative Grid Computing, Manuscript Grid Computing	High Performance Components	Examples of Real Time Computing Computing	Partitioning and parallel meshing technique	GCP Compute Engine overview
S-4	SLO-1	Working and Architecture of Grid computing	Compute, Network, Storage	**Unit 7: OpenMP programming**	Remeshing Overview, Business Benefits, Business Challenges, Applications of Remeshing	Advantages, Business Benefits, Applications of Compute Engine
	SLO-2	Cloud computing overview	Importance of High-Performance Computers	OpenMP programming Overview	**Unit 11: Networking and Storage Options for Advanced Computing**	Google Compute Engine features ✓ Machine Types ✓ Persistent Disks ✓ Local SSD
S-5 & S-6	SLO-1	**Lab 1 :** **Create a Google Compute Engine virtual machine and understand zones, regions, and machine types.**	**Lab 4 :** **Access files in Cloud Storage with the Spring Resource abstraction**	**Lab 7 :** **Set up and write simple programs on Apache Spark and Jupyter Notebooks on Cloud Dataproc**	**Lab 10 :** **Calculate multiplicative inverse of five symmetric matrices of size 2000x2000.**	**Lab 13:** **Use gcloud to create two custom VPC networks with subnets, firewall rules, and VM instances, then test the networks' ability to allow traffic from the public internet.**
	SLO-2					
S-7	SLO-1	Private Cloud, Public Cloud, Hybrid Cloud and Multi cloud	Business Benefits of High-Performance Computing	Business Challenges of OpenMP Programming	Networking Options for Advanced Computing Overview	Introduction to Containers and Kubernetes
	SLO-2	Working of Cloud computing	Business Challenges of High-Performance Computing	Parallel programming overview	Business Benefits, Business Challenges of Networking	Containers and Container Images
S-8	SLO-1	Architecture of Cloud computing	What can you do with High Performance Computing?	OpenMPparallel region, Worksharing	Storage Options for Advanced Computing Overview	Introduction to Kubernetes, Introduction to Google Kubernetes Engine
	SLO-2	Difference between Cluster vs Grid computing, Cluster vs Cloud computing and Grid vs Cloud computing	High Performance Computing in the cloud	OpenMP data environment, tasking	Business Benefits, Business Challenges for Advanced Computing	Kubernetes Architecture
S-9	SLO-1	**Unit 2: Role of Cloud Computing in An AI Implementation**	**Unit 5: High Performance Computing Building Blocks**	Creating Parallelism	**Unit 12: Google Cloud Platform Core Infrastructure and Services**	Google Cloud App Engine environments

	SLO-2	Merging AI and cloud computing	High Performance Computing Building Blocks Overview	**Unit 8: Message Passing interface (MPI) parallel programming**	Google Cloud Platform Core Infrastructure and Services	**Unit 15: Hands on Python Lab on GCP**
S-10	SLO-1	Machine learning cloud services	Why Is High-Performance Computing Important?	Message Passing interface (MPI) parallel programming	Introduction to Google Cloud, Getting Started with Google Cloud	Hello World
	SLO-2	IoT cloud	Business Benefits of High-Performance Computing	Business Benefits of MPI Programming	The Google Cloud resource hierarchy, Identity and Access Management (IAM)	Add Two Numbers
S-11 & S-12	SLO-1 SLO-2	**Lab 2 :** **Creating and Manage IAM Roles on Google Cloud**	**Lab 5 :** **Analyze Clinical Data using BigQuery and AI Platform Notebooks**	**Lab 8:** **Connect to computing resources hosted on Google Cloud Platform via the web**	**Lab 11:** **Create Kubernetes Cluster in Google Cloud Kubernetes engine**	**Lab 14:** **Perform basic networking tasks on Google Cloud, including Compute Engine instances**
S-13	SLO-1	Business Intelligence	Components of High-Performance Computing Solutions	Business Challenges of MPI Programming	Interacting with Google Cloud, Virtual Machines in the Cloud	Square Root of a Number
	SLO-2	AI as a Service on cloud	Compute, Network, Storage	Types of Parallel Computing Models	Storage, Containers, Applicationsin the Cloud	Area of a Circle
S-14	SLO-1	Infrastructure as a Service and AI	**Unit 6: In memory and Real Time Computing**	Error Handling	**Unit 13: Advanced Computing in Google Cloud Platform**	Quadratic Equation
	SLO-2	Platform as a Service and AI	In memory Computing Overview	Running MPI Programs	Interacting with Google Cloud	Swap Two Variables
S-15	SLO-1	Software as a Service and AI	Business Benefits In-memory Computing Overview	**Unit 9: Dynamic Load Balancing**	Using the Google Cloud	Mutiply Two Numbers
	SLO-2	Cloud technologies for AI applications	Business Challenges In-memory Computing Overview	Dynamic Load Balancing Overview	Working with GCP Cloud Console and Cloud Shell	Divide Two Numbers
S-16	SLO-1	Containers	Working of In-memory Computing	Business Benefits of Dynamic Load Balancing	Virtual Networks	Generate random Numbers between 0 and 100
	SLO-2	Kubernetes	Business Benefits of OpenMP Programming	Business Challenges of Dynamic Load Balancing	Virtual Private Cloud	Convert Kms to metre
S-17 &	SLO-1 SLO-2	**Lab 3:**	**Lab 6:**	**Lab 9:**	**Lab 12:**	**Lab 15:**

S-18		**Create Our First VPC in Google Cloud**	**Analyze production performance with Cloud Profiler**	**Build a Fraud Detection model on Cloud AI Platform with TensorFlow Enterprise and BigQuery**	**Creating a Network Storage Solution Using Google Cloud Filestore**	**Create a storage bucket and then use it to store some files, retrieve files, and implement version control.**

Learning Resources	1. Google Cloud Platform for Developers: Build Highly Scalable Cloud Solutions with the Power of Google Cloud Platform, Book by Steven Porter and Ted Hunter 2. Introduction to Computation and Programming Using Python, Book by John Guttag	3. Python for Google App Engine, By Massimiliano Pippi 4. Python Programming: Using Problem Solving Approach, Book by Reema Thareja

Learning Assessment											
	Bloom's Level of Thinking	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%) #**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	20%	15%	20%	15%	20%	15%	20%	15%	20%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	15%	10%	15%	10%	15%	10%	15%	10%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.Jothi, Periyasamy , Chief AI Architect DeepSphere.AI, CA, USA	Dr.S.Gopinathan, Associate Professor, University of Madras, Chennai	Dr.R.Jayashree, SRMIST
		Mrs.S.Chandrakala, SRMIST